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THEATERS, GARDENS AND HORTICULTURE[1]

By Dr. C. STUART GAGER

BROOKLYN BOTANIC GARDEN

I APPRECIATE the gracious words of President Nason, and I accept the award of the Arthur Hoyt Scott Foundation with a sense of profound gratitude to the committee of award, and especially to those who established the foundation, which has been, and which will continue to be, a potent factor in the encouragement and enrichment of American horticulture, in memory of one whose interest in plants reflected the highest ideals and accomplishments of a gifted amateur.

To be deemed worthy of a place in a group of medalists which includes Mr. John C. Wister, Professor Liberty Hyde Bailey and Mr. J. Horace McFarland, the previous recipients of this award, and Mr. Richardson Wright, to-day's recipient, is an honor which any one might justifiably covet.

And I specially appreciate the privilege and honor of having some part in the dedication of this beautiful outdoor theater, which adds so much to the cultural charm of Swarthmore College, already rich in cultural assets and traditions.

It is superfluous to say that every friend of Swarthmore is under special obligation to Mr. Thomas B. McCabe, of the class of 1915, whose generous interest in the college and in the promotion of all that is best in life has made this theater possible, as a memorial to Arthur Hoyt Scott.

The wish to be of service to mankind through the medium of botanical science, to help "the man in the

[1] Given at Swarthmore College on May 23, on the occasion of the presentation of the 1941 Arthur Hoyt Scott Garden and Horticultural Award of a gold medal and $1,000, and the dedication of a new open-air theater on the campus.

street," as well as the scientist, appreciate something of the beauty of the plant world, and of the significance and importance of a knowledge of plants, has been the inspiration of all that has been accomplished during thirty-two years at the Brooklyn Botanic Garden; and now to have this recognition as a token of public appreciation and approval, has aroused in the recipient "an emotion warmer than mere intellectual gratitude."

If anything has been accomplished at the Brooklyn Botanic Garden during the past thirty-two years worthy of such recognition as this, it is due to the support and encouragement of generous and philanthropic trustees and other citizens and to the loyal cooperation of an able staff, which has made possible the development of an institution after a pattern which, in its entirety, is essentially new for a botanic garden.

Nothing, of course, can surpass the solid satisfaction of being able to spend one's life in doing what one most likes to do. In 1675 the Italian, Malpighi, cofounder with Englishman, Nehemiah Grew, of the science of plant anatomy, wrote, "In performing these researches so many marvels of nature were spread before my eyes that I experienced an internal pleasure that my pen could not describe." Happy is the man who, as I can do, may write thus of his life-work. But there is a deep gratification also in being made to realize that the results of one's efforts have commended themselves to others who are competent to judge, and that they have been of benefit to mankind.

An outstanding award, such as this one, not only gives confidence and encouragement for the future, but it can not fail to direct favorable public attention to the undertaking thus recognized, and thereby encourage the moral and financial support without which no institution can prosper.

In the year 1593 Queen Elizabeth made an official visit to Oxford University. The Latin play performed in her honor was written by my ancestor, an Oxford don, the Christ Church dramatist, Dr. William Gager. The Puritans of that time were violently opposed to the theater, and Gager's Latin plays brought down upon him the wrath of this unfriendly sect, led by Dr. John Rainolds, of Queen's College, Oxford. To prove the ungodliness of Dr. Gager, Rainolds published a book, "Th' overthrow of Stage-Playes," which is famous in the history of the academic stage.

And so it has been of interest to me, and may possibly have a mild interest for this audience, that almost exactly 350 years after the noise of battle between the Puritans and my ancestor died away, a Quaker college, presided over by a president who is an Oxford graduate, now invites a descendant of William Gager to give an address in dedication of an outdoor theater on the campus. So the wheels of history go 'round!

In that unusual "Swarthmore Saga," "An Adventure in Education," by the Swarthmore College faculty, relating the advances made by the college during the nineteen years of the administration of President Aydelotte, it was possible to refer truthfully to the Swarthmore campus as "a campus which is one of the horticultural delights of eastern Pennsylvania." And one may now add the statement, with confidence, that no campus combines, at the same time, more educational value in horticulture with horticultural beauty. Nature has done much for the Swarthmore campus, and this has been taken advantage of to the fullest extent by the authorities—and notably in this newest feature of an outdoor theater, converting natural topography and scenery into a place of delightful outdoor assembly.

A brief word about the history of outdoor theaters and the term scenery may not be without interest at this time and place. As is well known, the word "theater" is from the Greek verb theáomai (*θεάομαι*), meaning "to view," "to behold," and giving us finally the word *théatron* (*θεατρον*), meaning "a place for seeing," "a theater." The theater, like most elements of our secular culture, originated in Greece. At first it was nothing more than a dancing circle or orchestra, (*ὀρχήστρα*) marked out around an altar, and, like this one, it was commonly located at the foot of a hillside on which the audience stood or sat. Later there were tiers of wooden seats built against the hillside for the audience. The most prominent and important object was an altar of Dionysus, placed in the center of the *orchéstra*. There was no stage, and the theater was regarded as the temple of Dionysus, who was the very heart of all Mediterranean religion.

In the classic theater on the southeast side of the Acropolis, in Athens, the temple of Dionysus Eleuthereus stood back and to one side of the circle, and to meet a need of the actors a tent was placed at the edge of the *orchéstra,* where the actors might retire for changes of costume. The Greek word for tent is *skene* (*σκηνή*), from which we have our words "scene" and "scenery."

It is common knowledge that, in their theaters, as in many other ways, the Romans copied the Greeks. The outdoor theater of Pompey, in Rome, built about 52 B.C., seated about 10,000 persons. At its inauguration some 500 lions and 20 elephants were killed by gladiators. To-day, it would appear, the outdoor theater is inaugurated or dedicated by a program which includes the slow torturing of the entire audience by an actor selected, as here and now, for that specific purpose.

But what has the theater got to do with horticulture? Dionysus, the divine patron of the drama, was also a "Year-God" or "Vegetation-Daemon," and the

death and re-birth of Dionysus are the very essence of Greek tragedy. The reawakening of vegetation every spring was regarded by the Greeks as heralding his resurrection. Dionysus was also the god of wine, the product of the vine, and the great philosopher, Spinoza, tells us that, "It is the part of a wise man to feed himself with moderate, pleasant food and drink, and to take pleasure . . . with the beauty of growing plants . . . and theaters."

How interesting to recognize that horticulture has been so intimately related to the most profound concerns of the human mind—to art, to science, to education, to the drama, to religion. And how fitting to have upon this campus, so interesting and so beautiful horticulturally, the added feature of an open-air theater.

When Aristotle, about 375 years before Christ, established at Athens the first "botanic garden" of record, and placed his pupil, Theophrastus, in charge of it, the main object, as in the Arthur Hoyt Scott arboretum, was to provide a place for growing native and foreign plants, thus making them more easily accessible for study. We are told that the botanical researches of Theophrastus were based primarily on this collection of plants.

But Theophrastus, like Aristotle, was essentially a teacher, and he embodied the results of his lectures on plants in nine books and published them. Thus, from this early and primitive botanic garden, there emerged the two fundamental aims of all subsequent botanic gardens, namely, the advancement and the diffusion of a knowledge and love of plants; thus, also, were set the standards and the limitations of the activities of botanic gardens for nearly two thousand years—the search for new knowledge and the publication of the results *for the educated minority* of mankind. And this statement is made not to criticize but to commend, for in this way the greatest need of botanical science was met.

It would be difficult to exaggerate man's ignorance of plant life from the time of Aristotle even up to the nineteenth century. We say that the function of a botanic garden is the advancement and diffusion of knowledge; but in Aristotle's time, and for many centuries thereafter, there was not only no receptive general public for popular scientific education, but there was very little botanical knowledge to diffuse. This was due in part to lack of research and in part to the stupefying influence of superstition.

Nowadays every schoolboy and every schoolgirl knows the parts of the flower and the functions they perform. In Aristotle's time practically nothing was known of this, and it was not until 1793—almost the beginning of the nineteenth century—that Christian Konrad Sprengel, by painstaking research, demonstrated beyond dispute the rôle of insects in transferring pollen from one plant or flower to another.

As for the effect of superstition on scientific inquiry, we may cite the statement of Jerome Bock. He was a teacher, preacher, physician and botanist. His *"New Kreuterbuch,"* first published in 1539, had six subsequent editions, and inaugurated the subject of plant description for the first time since Theophrastus. He was the first man to describe the stamen of flowers as made up of two parts, and the first to use the words "pistil" and "pollen." I refer to these matters as indicating his intellectual power and originality. He was one of the educational leaders of his time. But when he describes his investigations by which he was the first to discover that ferns reproduce by spores, he tells us that he made his observations on four successive years, in each case watching "all the night before the feast of St. John the Baptist." His own superstition and that of his contemporaries is further indicated by his statement that, "In these experiments I made use of no magic, or conjuring, or incantations"!

Illustrations of the newness of what is now common knowledge might easily be multiplied, but those just cited are specially appropriate to recall on this occasion, for they are foundational to the whole subject of plant breeding and ornamental horticulture. Without this knowledge of plant reproduction—of the structure and function of flowers—we should have only the "wild" flowers that "nature" provides, and we should lack all the innumerable horticultural varieties of iris and lilacs, peonies and roses, flowering cherries and chrysanthemums—not to mention the "bigger and better," earlier and prolificer varieties of fruits and vegetables with which our modern gardens are enriched. Without this knowledge it would be much more difficult to feed the enormous army we are now being forced to mobilize.

But civilization never stands still, and one of its greatest forward strides was the gradual but steady diffusion of democracy and, with democracy, of education among the masses. That which was known only to the intellectual aristocracy in the Middle Ages is now taught in all our public schools. It is not only free to all, it is compulsory to learn it.

The idea that the general diffusion of the method and results of science was second only in importance to scientific research has spread steadily, but all too slowly, since about 1875, when Asa Gray did not think it beneath his dignity as the greatest American botanist to write for public consumption his illuminating and non-technical little books on "How Plants Grow" and "How Plants Behave." This, and other similar instances, are striking illustrations of the truth that the humanizing and popularizing of knowledge are quite as important as the increase of knowledge.

In 1921, at the inaugural dinner for Dr. Aydelotte, the then new president of Swarthmore, Mr. George Walton, of the George School, wisely stated that "The Golden Age of Quakerism lies ahead. Its greatest activity will be education." It was such a recognition as this of the importance of education and of testing new ideas of education, that led to the formulation of the program of activities of the Brooklyn Botanic Garden when it was established in 1910. A new opportunity and therefore a new obligation for botanic gardens was recognized—not only that our knowledge of plant life should be promoted by scientific research, but that popular education concerning plant life should render to the general public a definite return in the way of public service along the lines of intelligent popular interest and public need. And so the keynote for the Garden was adopted and announced—"For the advancement of botany and the service of the City."

It seems fitting at this time to give a brief statement of the nature of the work as well as of the underlying philosophy for which the Arthur Hoyt Scott Award for 1941 has been made, for it is of general application.

For many years the Brooklyn Botanic Garden, so far as known to the speaker, has administered the most extensive and most varied program of popular public education of any botanic garden in the world, including not only what is now known as "adult education," but also courses of informal instruction for children in greenhouses and plantations. The scope and nature of the Garden's work has been stated as, "Anything scientific or educational based upon plant life," beginning with children's gardens (conducted primarily as an educational discipline) and including all aspects of botany and horticulture.

Many boys and girls have voluntarily attended these courses for children for from three to eight years consecutively, and many have thereby discovered their major interest in life, have taken their Ph.D. in botany and have become college professors of botany or horticulture or have gone into commercial horticulture for a life work.

The annual attendance at courses and lectures has averaged more than 100,000 a year. During the past twenty-nine years of the Garden's existence it has exceeded a grand total of more than 2,600,000 adults and children.

The plantations of the Garden have been developed as an outdoor museum of plant life. The diversity of the plantations, which comprise some twenty different kinds of gardens, led one of our friends to refer to them as "Gardens within a garden," and this designation has been officially adopted.

Of course the great tradition inaugurated by Aristotle's Garden—the advancement of botanical knowledge by research—has not been neglected. The investigations undertaken have resulted in substantial additions to knowledge which have been applied in connection with the maintenance of our own plantations, utilized in connection with a bureau of free public information, and given to the public through publications.

And I must mention one more aim and accomplishment as being most closely related to the interests of the founder and the namesake of the Arthur Hoyt Scott Foundation, and that is the beauty of the plantations. I quote from the Annual Report of the Garden for 1939:

> While the primary aim of the botanic garden is educational, we should minister not only to those who come to learn the Latin name of the Lilac, or what plant family comes between the Buttercups and Roses, or the latest variety of Iris, but also to those who come to seek only happiness and re-creation amidst beauty. And thus it becomes a fundamental aim to make the Brooklyn Botanic Garden as beautiful as possible.

The speaker's experience of thirty-two years has driven home the lesson that to develop an efficient botanic garden or arboretum takes time and patience and cooperation. Always and continuously it requires the education of the public and the trustees as to the aims and opportunities and requirements. That the highest efficiency requires adequate financing is a truism. That fact, however, is not always recognized and, when it is, it is not always easy to realize.

Just as plants grow old or obsolescent and have to be replaced from time to time with new or better plants, so also does knowledge about plants and their culture continually need revising and replacing with new ideas and information resulting from research.

In his "Ten-Year History" of the Scott Foundation, the present director, Mr. Wister, has stated this aspect of the work most effectively, pointing out the need of further studies in the breeding of ornamental plants, in their diseases, in their relation to their environment, in their nutrition, in their relationship to each other and in their naming.

The problems outlined, says your director, "are continuing ones, which could probably demand the attention of the Scott Foundation decade after decade." And I may add, it is attention to such necessary problems that raises a true arboretum or botanic garden above the level of a commercial nursery and makes it in a very real sense an educational institution.

The "Ten-Year History" quotes the great first director of the Arnold Arboretum, Professor Sargent, as stating that no plant collection can be worthy of scientific standing unless it has associated with it a first-class herbarium and a library. "There can be no doubt of their importance," says Mr. Wister, "even

if the point of view of this Foundation . . . is that of the practical gardener and not of the scientific botanist."

"Fundamentally," as he truly says, "the two points of view are, or should be, one," and I was gratified to read, with whole-hearted approval, his further statement that the Arthur Hoyt Scott Foundation "should be and is as much interested in scientific achievement as are any other botanical gardens."

As every one knows, we are now living in a most terrible period of the world's history. We are engulfed in a world revolution. It is a revolution of annihilation. Its aim, partially accomplished, is the obliteration of every moral, religious and educational standard and value. The civilization of human freedom and opportunity, into which you and I were born and with which we have been familiar all our lives, is threatened with extinction. Much of the old will permanently pass away, but everything possible of value must be salvaged from the old and incorporated into the new civilization to come.

These values have been stated so recently and so frequently that it is not necessary to enumerate them here. They include the advancement and diffusion of knowledge, of a love of truth and beauty, and a freedom to cultivate whatever emancipates the spirit of man from all that is sordid and base, from ignorance and superstition.

The only war of aggression that was ever fought to attain these ends has been waged by our churches, our institutions of science and art, our schools and colleges, our museums and botanic gardens—not by guns and bombs, but by the method of St. Paul, of overcoming evil with good, ugliness with beauty, ignorance with knowledge. What a privilege it is to be free to have some part, however small, in leading the coming generations in America toward a higher and still higher type of Christian civilization. Said Lord Tweedsmuir, in his autobiography, "Politics is still the greatest and most honorable adventure." We agree with this with one exception; for "politics" we would substitute the word "education."

THE SMITHSONIAN INSTITUTION AS AN ILLUSTRATION OF INTERNATIONALISM IN SCIENCE[1]

By Dr. CHARLES G. ABBOT

SECRETARY OF THE SMITHSONIAN INSTITUTION

ON October 23, 1826, James Smithson, the natural son of Hugh, Duke of Northumberland, and of Elizabeth Macie, a lineal descendant of King Henry the Seventh, made his will. It contained this provision: "In the case of the death of my said Nephew without leaving a child or children . . . I then bequeath the whole of my property . . . to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an Establishment for the increase & diffusion of knowledge among men."

This provision became effective on June 5, 1835, and became known at our State Department in September, 1835. President Jackson announced the matter to Congress in December. Senators Calhoun and Preston of South Carolina strongly opposed acceptance, but Senators Jefferson Davis of Mississippi and Leigh of Virginia recommended it, and after some months prevailed. In the House, ex-President John Quincy Adams was a strong advocate, and secured the approval there. On July 1, 1836, the President approved the bill of acceptance, and at once sent Richard Rush of Philadelphia to England to prosecute the claim in the Court of Chancery. Through Rush's tact and diligence and through the aid of English friends, the mission was accomplished in two years, notwithstanding that in those days chancery suits sometimes began with a man's lifetime and their termination became a feature of his epitaph.

On May 9, 1838, the Court of Chancery handed down its epoch-making decree adjudging the Smithson bequest to the United States. Mr. Rush sailed with the gold in the packet ship "Mediator" and deposited £105,000 at the United States Mint in Philadelphia on September 1, 1838.

Eight years later, after prolonged debates in Congress regarding this unprecedented gift, the Smithsonian Institution was founded by the enabling act approved August 10, 1846.

The Institution is the ward of the Government. It is governed by a Board of Regents comprising the Vice President, the Chief Justice, three Senators, three Representatives and six eminent citizens. Their Secretary is the Executive Officer.

The Regents were particularly happy in selecting Professor Joseph Henry of Princeton, the eminent discoverer in electricity, to be their first secretary. He conceived the plan of operations which has been followed for nearly a century, which has made the Insti-

[1] World-wide broadcast of the American Philosophical Society and WRUL, Philadelphia, May 15, 1942.

tution honored throughout the world, and highly useful to the people and Government of the United States.

Briefly, the plan is to increase knowledge by doing original research in fields not fully cultivated elsewhere, and by making grants, as means permit, to investigators who show promise. To diffuse knowledge, the Institution publishes its own researches and occasionally those of others, and distributes its publications without cost to about 1,500 libraries and specially interested individuals all over the world. It also collects each year and publishes in the original or in translation, as the Appendix to its Annual Report, about 25 articles from sources not generally available, including foreign as well as domestic authors, and even preferring to use foreign sources difficult of access here. These articles are chosen to set forth in simple but accurate terms the outstanding news in scientific discovery, so that non-specialist readers can understand what's worth while and follow the chief advances in science.

Besides these publications, the Institution, in further diffusion of knowledge, conducts a zoological park and several museums of art, industry, history and natural history which are visited by two and one half millions of people annually. It also gives information by letter to many thousands of inquirers each year, sponsors a weekly half-hour radio program, "The World is Yours," and gives occasional lectures. It originated and still administers the International Exchange Service, through which our Government and many American institutions exchange parliamentary proceedings and scientific documents with countries in all parts of the world.

The Institution has sent exploring and collecting parties to all the continents and most of the islands, and its correspondence and distribution of publications is very copious and equally far-reaching. Exchanges have built up the Institution's scientific library to three quarters of a million items, and these it has loaned to the Library of Congress, in order to extend their usefulness.

For some years the Institution had in its hall a column of books, 4 books square and 23 feet high, which were all Smithsonian research publications. The label truly informed the visitor that hardly a textbook or an encyclopedia or scientific work of recent times exists which does not make use of knowledge recorded in these volumes.

Such is the Institution of world-wide influence for culture, useful knowledge and peaceful aims which was set up by that scientific statesman, James Smithson. A less far-sighted man would have made his bequest solely to relatives, or at the best to some charity in his native land. But Smithson was interested unselfishly in the advancement of all mankind through knowledge, and wonderfully has his bequest succeeded in promoting his ideal.

Those of us who can look a little backward through the years to the times before the first world war, recall the happy state of international relations. A traveler then could go almost throughout the world without a passport. Discoveries, without regard to their money value, were published in the language of their author, and distributed to scientific readers everywhere. Complete faith in the honest intentions of all scientific research workers was the rule. Results obtained in one country were used as the basis on which to build further knowledge in all. Such was the attitude of mind which was then prevailing in scientific circles, and under such genial conditions knowledge increased by leaps and bounds.

Think of the development of electricity from Faraday and Henry, about 1830, to include the dynamo and the street car. Remember Edison and the electric light. Recall Henry and Morse and the telegraph; Bell and the telephone; Hertz and Marconi and the radio. Household conveniences multiplied, such as fans, toasters, refrigerators, bells and hosts of others. Think of Röntgen and the x-ray and its use in surgery; of Pasteur and antisepsis; of preventive medicine with its engineering sanitary aids all unknown in Smithson's day. Think of the astonishing progress in the chemistry of carbon, leading to medicines, plastics, colors, gas and gasoline. Think of the Curies and radium leading to the intimate study of the structure of the atom. Think of Einstein and relativity bringing a new philosophy to be the complement of that of Sir Isaac Newton. Here we see men and women of many countries in a united friendly effort, giving all mankind new thoughts and new conveniences, prolonging life and enriching it.

That was the vision to which James Smithson devoted his fortune. It has not only accomplished much directly through the Smithsonian Institution, but Smithson's deed has become so well known that it has led many others in many countries to emulate him in founding research institutions, and in helping to increase and diffuse knowledge without narrow or selfish limitations.

A notable instance is the establishment of the Nobel prizes. Alfred Bernhard Nobel was a Swedish chemist and engineer who devoted himself to the improvement of high explosives. He amassed great wealth in connection with the development of the Russian oil fields. Dying in 1896, he left most of his fortune to establish five large prizes to be awarded by certain Scandinavian agencies without regard to the nationality of recipients. The first three prizes are awarded for eminence in physical science or physiology. The

fourth is for the most remarkable current literary work of an idealistic tendency. All hail to the fifth! It is given to the person or society that renders the greatest service to the cause of international brotherhood, in the suppression or reduction of standing armies or in the establishment or furtherance of international congresses to promote peace. Numerous Nobel prizes have been given and to representatives of many countries.

The friendly relations which prevailed among all nations, before the world wars of this century, fostered and were fostered by the international societies which grew up among the eminent men of science in each of its principal branches. Every science from astronomy to zoology, throughout the alphabet, had its occasional congresses held in turn in the different nations. Fast friendships were formed across the seas. It was inspiring to meet the eminent discoverers, whom one had grown to admire through their published works, to be found in the scientific libraries of all nations.

These congresses took up world problems in science, assigned suitable parts to the several nations harmonious to their opportunities, and thus astonishing progress often followed, far beyond what individuals could have done without organized cooperation.

In recent time we lament to see a reaction against this friendly policy of Smithson and of Nobel. Germany fifty years ago was revered as a world's leader in culture. American students who wished to be liberally educated went by thousands at great financial sacrifice to enjoy the benefit of the invigorating German scientific atmosphere. But now, we are informed, not only are illustrious Germans like Einstein obliged to fly from their country, but science, art, religion and truth itself are warped and emasculated so as not to appear to contradict the cruel and hateful policy of the German rulers. All information is censored and death is the penalty for listening to the news broadcast from other nations. In conquered countries the Germans seek to exterminate culture and reduce the inhabitants to slavish status. Our lines have run into very dangerous times. Truth is gravely threatened. Free peoples everywhere emulate one another in the sacrifice of their dearest possessions to preserve for the world the Smithson ideal of altruistic increase and diffusion of knowledge among all men.

SCIENTIFIC EVENTS

DEATHS AND MEMORIALS

DR. FRANCIS RAMALEY, professor of biology emeritus of the University of Colorado, botanical editor of *Ecology*, died on June 10, in his seventy-second year.

DR. ROY K. FLANNAGAN, medical director of the department of public health of Virginia, died on June 18, at the age of seventy-one years.

DR. LAURENCE S. MOYER, of the department of botany of the University of Minnesota, was killed recently in a blimp accident near Atlantic City while on a mission for the Navy.

DR. WILLIAM A. BRYAN, director of the Los Angeles Museum of History, Science and Art, died on June 18, at the age of sixty-six years.

DR. A. R. FORSYTH, emeritus professor of the Imperial College of Science and Technology, London, died on June 2, at the age of eighty-four years.

Nature reports the death of Professor Charles Cohen, formerly of the Pasteur Institute, Brussels, aged sixty-one years; of Dr. John Miller, director of aircraft production (factories), formerly chief engineer, London and North-Eastern Railway; of Professor G. A. Witherington, formerly of the department of mathematics in the Royal Naval College, Greenwich, aged sixty-nine years, and of Dr. Bernhard Fischer-Wasels, professor of morbid anatomy at Frankfort-on-Main, president of the German Pathological Society and editor of the *Frankfurter Zeitschrift für Pathologie*, at the age of sixty-five years.

IN connection with the seventy-fifth anniversary celebration of the founding of the Torrey Botanical Club, the department of botany of Columbia University observed the fiftieth anniversary of its organization as a separate department of the university and the one hundred fiftieth anniversary of the appointment of the first professor of botany in Columbia College, then at Astor Place in lower Manhattan. Dr. Richard S. Kissam was appointed to the chair of botany on February 20, 1792, and was thus the third designated professor of botany in America, being preceded in point of time only by Adam Kuhn in 1768 and Benjamin Barton in 1789 at the College of Philadelphia. The department of botany was eventually organized a hundred years later as a distinct school at Columbia by Dr. Nathaniel Britton. In observance of these anniversaries an exhibit depicting the development of botany at Columbia was held in Low Memorial Library during the month of June.

GRASSLAND RESEARCH IN GREAT BRITAIN[1]

THE appointment of Sir George Stapledon as the director of the Ministry of Agriculture Grassland Improvement Station, Dodwell, marks a break in a long period of pioneer service which may be said to

[1] From *Nature*.

have revolutionized the current methods of grassland management. After holding the posts of professor at Cirencester and adviser in agricultural botany at Aberystwyth, Sir George became the first director of the official Seed Testing Station when it was founded by the Food Production Department of the Ministry of Agriculture during the war of 1914–18. Thence he proceeded to the chair of agricultural botany at Aberystwyth and also became director of the Welsh Plant Breeding Station when it was founded in 1919. Gathering round him a band of enthusiastic and patient research assistants, he began the long series of experiments which have made his work famous the world over.

So early as 1913 Sir George was interested in pasture problems, such as drought resistance, and the response of grassland species under manuring, and in 1916 he collaborated with his present successor, T. J. Jenkin, in investigations on indigenous species in relation to habitat and sown species. For the next twenty-five years his attention was devoted to the various ways in which the grasslands of Great Britain could be improved and better use made of the great acreage of unprofitable and neglected pastures up and down Great Britain. The importance of varieties and strains was fully recognized, and geneticists and plant breeders on his staff concentrated their attention on the production of the special types of the herbage plants needed for specific purposes. The labor involved was immense, and only by most skillful organization has it been possible to carry through the work without confusion or delay, and to apply the results to agricultural practice. Varieties of grasses and clovers have been bred for earliness or lateness, for leaf or stem production, for spreading or erect types, to provide seed to meet different requirements.

Parallel with the plant-breeding work, problems of management were investigated, particularly in relation to the effects of grazing, and the most amazing and valuable results were obtained. But all the time Sir George was working towards his main object of obtaining recognition from the government and farmers alike that poor or derelict pasture could be so improved as to become an important asset instead of a liability. Much preliminary critical work was carried out, the importance of buried and viable seeds in the soil being early recognized. Then in 1933 the station acquired Cahn Hill, whereon large-scale hill experiments could be made in order to develop methods whereby improvements could be made and to determine their economic value. Much progress has been made, both on the hill pastures and in connection with ley farming, in which poor permanent pasture is improved by ploughing up and reseeding. Sir George Stapledon's new appointment will provide an excellent opportunity to demonstrate the value of his ideas, backed by wide experience, and the venture will be followed with great interest by all who have the interests of agriculture at heart.

THE INSTITUTE OF AERONAUTICAL SCIENCES

AN account is given in the *New York Herald Tribune* of the gift of the Daniel Guggenheim estate at Sands Point, L. I., to the Institute of Aeronautical Sciences for the establishment of a center for aeronautical research and study. The gift was made by Mrs. Guggenheim in memory of her husband, who during his lifetime gave several million dollars for the advancement of aeronautical sciences.

The Guggenheim estate, near Port Washington, L. I., contains 162 acres, with two thirds of a mile of shore front and a forty-room house overlooking Long Island Sound. It has been named Daniel Guggenheim Park by the council of the institute. A board of trustees will supervise arrangements for the use of the property and will appoint a board of scientific advisers to conduct aeronautical research. In accepting the gift from Mrs. Guggenheim, the institute consulted with her son, Lieutenant Commander Harry F. Guggenheim.

Daniel Guggenheim established the Daniel Guggenheim Fund for the Promotion of Aeronautics in 1926 with a gift of $2,500,000, which was subsequently increased. He previously had established the Guggenheim School of Aeronautics at New York University, and the fund endowed schools of aeronautics at the Massachusetts Institute of Technology, the Georgia School of Technology, the California Institute of Technology, the University of Washington, Leland Stanford University, Syracuse University and the University of Michigan. The fund also established a chair of aeronautics in the Library of Congress, made the first equipment loan in this country to establish aerial passenger service, set up the first complete aeronautical weather-reporting service and established a safety prize.

The Institute of Aeronautical Sciences, which now has headquarters at Rockefeller Center, was organized in 1932 and has forty-seven branches throughout the country and a library of more than 12,000 aeronautical publications.

AWARDS FOR EXHIBITS AT THE MEETING OF THE AMERICAN MEDICAL ASSOCIATION

AT the ninety-third meeting of the American Medical Association in Atlantic City, gold, silver and bronze medals were presented by the committee on award of scientific exhibits. The awards in Group 1 were for exhibits of individual investigations, which

are judged on the basis "of originality and excellence of presentation." Those in Group 2 were for exhibits "which do not exemplify purely experimental studies and which are judged on the basis of excellence of presentation and correlation of facts."

The awards in Group 1 were a gold medal to Drs. Eben J. Carey and Leo C. Massopust, Marquette University Medical School, for their studies showing why a person jumps at a flash of lightning, quivers in anticipation of danger or springs to defense in an emergency; a silver medal to Drs. Deryl Hart and Samuel E. Upchurch, Duke University School of Medicine, for an exhibit showing the use of electrical radiation in sterilizing the air of operating rooms; a bronze medal to Dr. O. V. Batson, Graduate School of Medicine, University of Pennsylvania, for his demonstration of the method by which cancer and other diseases spread through the body.

The awards in Group 2 were a gold medal to Drs. John C. Bugher and Manuel Roca-Garcia, of the National Department of Health, Bogota, Colombia, for their exhibit on the means by which jungle fever is spread by mosquitoes; a silver medal to Dr. Emanuel Libman, of the Mount Sinai Hospital, New York City, for his studies on heart disease; a bronze medal to Drs. L. M. Randall, M. C. Piper, L. A. Brunsting and M. B. Dockerty, the Mayo Clinic, for their work on cancer of the ovary.

Special "certificates of appreciation" were awarded to eleven exhibits from Latin-American republics. There were also a number of certificates of merit. Special certificates of merit were given to demonstrations on diabetes and the Kenny method for the treatment of infantile paralysis.

NEW YORK MEETING OF THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

THE fiftieth annual meeting of the Society for the Promotion of Engineering Education will be held on June 27, 28 and 29 at Columbia University. The entire series of meetings, discussions and addresses, under the presidency of A. H. White, will be devoted to the general subject, "The Task of the Engineering Colleges in the War Effort." The meeting this year is being held under the auspices of the twelve engineering colleges in the New York metropolitan region. Most of the meetings will be held at Columbia University, but on Monday various groups will visit other engineering schools for group discussions.

Registration will be at the Low Memorial Library on Friday night. The first general session will convene on Saturday morning. A. H. White, president of the society, will preside, with addresses of welcome by Dean Thorndike Saville, of the College of Engineering at New York University, chairman of the Engineering College Administrators of the New York Metropolitan Area; James K. Finch, associate dean, Columbia University, and J. S. Morehouse, chairman, Middle Atlantic Section of the society.

Joseph W. Barker, assistant to the Assistant Secretary of the Navy, will discuss at this session the Navy's need for engineers. Brigadier General R. C. Crawford, commandant of the Engineer School, Fort Belvoir, Va., will speak on "What the Engineering Schools are Doing and should Do to Further the War Effort." The enlisted reserve corps program of the United States Army, a new development under which college students may enlist in the army and qualify for commissions, will be discussed by Lieutenant Colonel C. E. Hixon, of the military personnel division of the Services of Supply. W. O. Hotchkiss will discuss the Army Specialist Corps, and Professor White will deliver his presidential address. Group conferences will be held on Saturday afternoon.

The second general session will open on Sunday at 10 A.M., at which time William L. Batt, director of materials of the War Production Board, will head a list of government officials in addresses concerning the war task of engineering colleges. Others on the program include Dr. Leonard Carmichael, director of the National Roster of Scientific and Specialized Personnel; Dr. Karl T. Compton, Office of Scientific Research; W. H. Kushnick, director of the Civilian Personnel Training, and F. J. Kelly, chief of the Division of Colleges and Professional Schools of the U. S. Office of Education. Following the addresses and discussion, new officers of the society will be elected.

The third general session will take place on Sunday afternoon at 2:30 P.M., when the speakers will include George W. Case, engineering, science and management defense training; A. M. Greene, special consultant to the War Production Board; D. B. Prentice, chairman of the committee on acceleration of regular engineering programs; and W. E. Wickenden, chairman of the committee on conservation of engineering students. The annual dinner will be held in the evening, when the award of the Lamme Medal will be made.

On Monday divisional meetings will be held at other engineering schools. Host institutions to the meetings, in addition to Columbia University, are the Polytechnic Institute of Brooklyn, Cooper Union, Manhattan College, New York University, the College of the City of New York, the Newark College of Engineering, Pratt Institute, Princeton University, Rutgers University, Stevens Institute of Technology and the Webb Institute of Naval Architecture.

SCIENTIFIC NOTES AND NEWS

THE doctorate of science was conferred on June 16 at the commencement exercises of Princeton University on Dr. Richard Chace Tolman, professor of physical chemistry and mathematical physics at the California Institute of Technology and vice-chairman of the National Defense Research Committee, and on Childs Frick, honorary curator of late tertiary and quaternary mammals at the American Museum of Natural History and trustee of the museum.

DR. GEORGE HARRISON SHULL, professor of botany and genetics at Princeton University, was awarded the degree of doctor of science at the commencement of the Iowa State College in recognition of his early research leading to the discovery of the scientific basis for hybrid corn.

THE doctorate of laws was conferred on June 19 at the commencement exercises of New York University on Dr. Frederick P. Keppel, from 1923 to 1941 president of the Carnegie Corporation.

AT the recent commencement exercises of the University of North Carolina Dr. William S. Tillett, professor and head of the department of medicine of the New York University Medical School, was awarded the honorary degree of doctor of science.

J. R. VAN PELT, head of the curatorial department of the Chicago Museum of Science and Industry since 1930, has received the honorary degree of doctor of science from Cornell College, in recognition of his contribution to better public appreciation of pure and applied science.

A TESTIMONIAL dinner in honor of Professor Albert Ball, head of the department of physics at Cooper Union, who is retiring after thirty-seven years of service, was given on May 28 by forty-nine past and present members of the faculty at the Hotel Lafayette in New York City. A bound volume containing seventy-two letters of tribute was presented to him by George F. Bateman, dean of the Engineering School. Other speakers included Gordon Thompson, Class of 1909, chief engineer of the Electrical Testing Laboratory; Professor Harold W. Merritt, who becomes senior member of the department of physics, and Professor Ball. J. Charles Ridel, chief engineer of the New York City Board of Estimate and Apportionment, was toastmaster.

IT is reported in the *Journal* of the American Medical Association that Dr. Jacob C. Krafft, clinical professor of pediatrics at the Loyola University School of Medicine, on May 13 was the guest of honor at a dinner given by the Northwest Branch of the Chicago Medical Society and by friends, in recognition of his many years of service in the profession and in special recognition of his work in the care of the mentally handicapped child. Dr. Krafft was presented with a sphygmomanometer.

PROFESSOR M. GREENWOOD, head of the department of epidemiology and vital statistics at the London School of Hygiene, has been elected an honorary fellow of the National Institute of Sciences of India.

THE newly elected officers of the University of Southern California Chapter of the Society of the Sigma Xi are: Dr. Thomas Clements, *President* (geology); Dr. Arthur Wyckes Nye, *Vice-president* (physics); Dr. Sydney Duncan, *Treasurer* (engineering), and Dr. Francis Marsh Baldwin, *Secretary* (zoology).

OFFICERS of the Association of College Geology Teachers have been elected as follows: *President,* Percival Robertson, of The Principia College; *Vice-president,* David M. Delo, of Knox College; *Secretary-Treasurer,* Katherine F. Greacen, of Milwaukee-Downer College.

DR. HENRY J. MASSON, for twenty-five years a member of the faculty of the College of Engineering of New York University, has been appointed assistant dean of the college. Dr. Masson, who is now director of the graduate and evening divisions, is also chairman of the department of chemical engineering.

DR. R. G. GUSTAVSON, professor of chemistry at the University of Colorado, has been appointed dean of the Graduate School, to succeed Dean O. C. Lester, who retires at the end of the summer session.

DR. WALTER L. HARD, assistant professor of zoology at the University of Maryland, has become assistant professor in the department of histology and embryology of the School of Medicine.

THE *Journal* of the American Medical Association states that Dr. Leopoldo Luis Benedetti B., Panama, has been awarded a fellowship in pediatrics by the American Academy of Pediatrics, the training to be carried out at the College of Medicine of the University of Cincinnati.

CLYDE W. LEAF, of the Girandau-Delawanna, Inc., has been appointed organic chemist in the chemical engineering section of the Armour Research Foundation.

DR. R. A. ROGERS, of the department of physics of Park College, Parkville, Mo., has been appointed by the Bureau of Aeronautics of the Navy Department Ground School instructor in physics, mathematics and meteorology.

RECENT appointments in the office of the Medical Division of the Office of Civilian Defense include Dr. Dean A. Clark, since 1939 surgeon of the staff of the Division of Public Health Methods of the National Institute of Health, who has been appointed head of a hospital section organized to carry out the new program recently announced by the OCD and the Federal Security Agency. Dr. Clark will also be placed at the head of a new Emergency Medical Section in the Public Health Service, which will administer the program jointly with the Medical Division.

DR. CHARLES ARMSTRONG, senior surgeon of the Public Health Service and director of the division of infectious diseases of the National Institute of Health, is convalescing at Hamilton, Mont., from a severe attack of tularemia (rabbit fever). He was taken ill on May 25, a few hours after his arrival on an official visit to the Rocky Mountain Spotted Fever Laboratory at Hamilton.

DR. REGINALD FITZ, Wade professor of medicine in the School of Medicine of Boston University and member of the council on medical education of the American Medical Association, delivered on June 18 the commencement address at the College of Medicine of the University of Vermont.

IN recording the honorary degree conferred by Franklin and Marshall College on Dr. William Henry Welker, his position was given as head of the department of physical chemistry of the University of Illinois. This should have read the department of physiological chemistry of the College of Medicine.

Nature states that an Association of Austrian Engineers, Chemists and Scientific Workers in Great Britain has recently been formed. The main activities of the association will be to assist members in their professional work and interests, to represent them with the authorities, to promote contact and relations with British colleagues and to form a link with British scientific and technical institutions. Lectures, courses and discussions will be held and will give opportunities for the exchange of views and to discuss matters of mutual interest. It is hoped that the association may assure that better use is made of the knowledge and abilities of Austrian engineers, chemists and scientific workers who are anxious to assist in the war effort. The acting chairman of the association is Dr. F. Ehrenfest-Egger; inquiries should be sent to the honorary secretary, Mrs. K. Hilfreich, 133 Hatherley Court, London, W.2. Lectures are being given on the first Monday of each month. Every Monday, commencing June 1, at 7 P.M., a clubroom will be open for members of the association at the Austrian Center, where there will be opportunities to read technical periodicals and to meet other colleagues.

THE Council of the British Institution of Electrical Engineers has made the following awards of premiums for papers read or accepted for publication during the session 1941–42: *Institution Premium* to J. M. Meek; *Ayrton Premium* to J. S. Forrest; *Fahie Premium* to Dr. W. G. Radley and E. P. G. Wright; *John Hopkinson Premium* to Dr. A. L. Williams and L. E. Thompson; *Kelvin Premium* to E. Colin Cherry; *Overseas Premium* to Professor K. Aston and M. V. Kesava Rao; *Extra Premiums* to Dr. A. H. M. Arnold, G. W. Bowdler, G. W. Bowdler and W. G. Standring, R. Davis, Dr. H. D. Einhorn and Professor B. L. Goodlet, Dr. Hackett and A. M. Thomas, E. A. Richards, V. Sia, R. C. Woods and A. S. MacDonald; *Installations Section Premiums* to L. J. Davies, H. R. Ruff and W. J. Scott (Crompton Premium), R. Grierson; *Meter and Instrument Section Premiums* to E. A. Burton, J. S. Forrest and T. R. Warren (Silvanus Thompson Premium), D. J. Bolton; *Transmission Section Premiums* to J. W. Leach (Sebastian de Ferranti Premium), W. Casson and F. H. Birch; *Wireless Section Premiums* to O. S. Puckle (Duddell Premium), Dr. D. C. Espley and D. O. Walter (Ambrose Fleming Premium), J. E. Thwaites and F. J. M. Laver.

THE Army unit of the New York Hospital and Cornell Medical College has been called into service, and its personnel reports for active duty on July 15. As the Ninth General Hospital, the unit bears the same number as the New York Hospital in France, which cared for 15,000 men of the American Expeditionary Force in the last war. Fifty-five doctors, 120 nurses and a number of non-professional employees will leave the hospital for service with the detachment. Chief of the Surgical Service will be Dr. Ralph F. Bowers, attending surgeon, and the head of the Medical Service will be Dr. Bruce Webster, assistant attending physician, each with the rank of lieutenant-colonel.

THE sum of $250,000 has been given by an anonymous donor to the Brush Foundation of Western Reserve University for research and education. The work will be under the supervision of Dr. William Walter Greulich, professor of physical anthropology and anatomy, director of the foundation.

THE Laboratories of Nutritional Biochemistry of the Massachusetts Institute of Technology have been granted $12,300 by the Rockefeller Foundation to be used during the twelve-month period beginning on July 1. Under this grant research on development of emergency rations and food mixtures for armies and distressed populations under the direction of Professor Robert S. Harris will be continued. A similar grant was made by the Rockefeller Foundation last year.

MRS. ALEXANDER LOWY has established a fund in memory of her late husband, who for over twenty years was professor of chemistry in the University of Pittsburgh. This fund is to help students in the course leading to the degree of bachelor of science in chemistry or to the Ph.D.

THE two Lynn, Massachusetts, plants of the General Electric Company, employing 25,000 workers, received the Navy "E" on June 19 for excellence in turning out war equipment. The pennant was presented on the same day to the Bound Brook, N. J., plant of the Bakelite Corporation, which produces a synthetic electrical insulation.

Nature writes: "We understand that the trustees of Charles Darwin are considering disposing of original MSS of Darwin's which are in their care. These include the manuscript journal kept by Darwin during the voyage of the *Beagle* (1831–36) on which was based his 'Journal of Researches into the Natural History and Geology of the various countries visited by H.M.S. Beagle . . .'; Darwin's autobiography in his own handwriting with alterations made or suggested by Mrs. Darwin; the manuscript of 'The Effects of Cross- and Self-Fertilization in the Vegetable Kingdom'; the 1844 sketch of 'The Origin of Species,' and a large number of letters and miscellaneous material, most of which has been published. Although this material may contain little of strictly scientific value, it has an obvious interest to the historian of science as revealing the workings of Darwin's mind at different periods of his life, and it would be unfortunate if the material should be dispersed. Such documents should be preserved in a library where access to them can be had by students, and it is to be hoped that some benefactor of science, aided perhaps by the Friends of the National Libraries, or some similar body, may be able to secure them for that purpose."

AT the request of the British Minister of Agriculture, the National Institute of Agricultural Botany has set up a special Seed Production Committee the duty of which will be to take all possible steps to stimulate, coordinate and ensure home seed production. The chairman of the committee is W. Gavin, agricultural adviser to the Ministry of Agriculture.

DISCUSSION

POST-GLACIAL CLIMATIC AMELIORATION AND THE EXTINCTION OF BISON TAYLORI

THE extinction of the late glacial bison species or races variously assigned to *occidentalis, antiquus* and commonly of late designated as *Bison taylori,* has become a matter of more than ordinary interest to the archeologist. Followed on the time scale, as it is, by a closely related and still existing species, its possibilities as an index fossil are considerable. Unfortunately, as in the case of other Ice Age forms, considerable mystery has clothed its demise. Similar mystery attends the first appearance of *Bison bison,* the succeeding form.

Bison taylori has been reported associated with human artifacts over a wide area of the High Plains. In certain instances, however, the identifications were not based upon the evidence of skull characters which are, at the present time, the only diagnostic features carrying entire conviction. To date *Bison bison* remains have not been reported intermixed with the extinct species upon any of these sites, yet it is a reasonable assumption that the two species overlap at some point on the late Pleistocene or early Recent time scale.

Indeed, a recent assertion in Hibben's monograph on Sandia cave[1] as to the presence of a form "near but smaller than *taylori*" leads us to wonder whether a smaller type may not have existed contemporaneously in the southern regions—though the size range in both *Bison bison* and *taylori* is not sufficiently known to clarify the situation, a state of affairs which tends to vitiate evidence drawn from limb fragments alone.[2]

It has been intimated occasionally that climate could not have been a major factor in the extermination of the Pleistocene fauna[3] because these animals survived the great ice movements only to disappear at their close. In the case of certain northern forms, at least, this has always seemed to the present writer like a dubious and wilful inversion of a much more reasonable assumption; namely, that some species adapted to more boreal conditions were poorly adjusted physiologically to the climatic amelioration which attended the recession of the last ice sheet. This is not to assign climate a single role in the process of extinction. It is obvious, however, that under conditions of increased temperature, species contending for survival

[1] Frank C. Hibben, *Smithsonian Miscellaneous Collections,* 99: 33, 1941. See also the present writer's review of this work in *American Antiquity,* 7: 4, 1942 (in press).

[2] Interesting in this connection is the fact that Figgins and others have noted a greater spread in the horn cores of the existing species as one progresses from south to north. Indeed Figgins speculates on the basis of stratigraphic evidence that *Bison bison bison,* which he recognizes as the shorter-horned variety, has extended its range northward in more recent times. (J. D. Figgins, *Proceedings of the Colorado Museum of Natural History,* 12: 26, 28, 1933.)

[3] A. L. Kroeber, "Conclusions: The Present Status of Americanistic Problems," Chapter 34, "The Maya and Their Neighbors," Appleton-Century, New York, 1940.

might undergo delicate alterations in ecological balance, due to reduced fecundity and vitality.[4] It might give, for example, to a more southern variety of otherwise similar habits, a chance to expand over the retreating range once held by a more rugged and cold-resisting form. Ultimately the latter might be bred out or replaced.

Bearing upon this point, there exists a certain amount of data from scattered sources which the writer believes are worthy of some degree of attention and which he has not seen organized with this problem in mind. First and most importantly, we encounter information detailing the effects of hot dry climate upon northern European cattle whose bovidean affinities are not too remote to invite serious analogies with the extinct *Bison taylori*. This latter animal, slightly larger and undoubtedly heavier pelted than the existing buffalo, moved in a cooler and more humid world than the historic species. Almost certainly he was capable of enduring more difficult winters. What happened, then, when the ice fell back?

The information dealing with European cattle, to which we now proceed, suggests a tentative explanation. Though climate may influence animals indirectly through its effect upon pasturage, for example, experimenters with live stock have noted that for these animals "there are optimum climatic conditions under which they will develop and produce best within the limits of their inherent capacity."[5] Many observations testify to the reduced vitality of European cattle under higher temperatures both as to milk production and fertility. Exposure to strong sunlight in summer causes a higher respiration rate, and the rise in body temperature indicates increased difficulty in the reduction of body heat. It has been observed that in hot climates cross-breeding of European cattle with tropically adapted bovids strengthens and improves the strains, suggesting favorable genetic distinctions in the ability of the southern types to adjust to warmer conditions.

Now the available evidence upon *Bison bison* suggests that in terms of ruggedness of physique, the northern phase or variety *Bison bison athabascae* approached most closely to the extinct *Bison taylori* in size.[6] Can it not be reasonably suspected, then, that *Bison bison* may have existed originally as a southern variant which, by reason of greater adaptability to heat and perhaps more impoverished and less succulent grazing conditions, expanded its range in the closing Pleistocene or early Recent at the expense of its larger and less heat-resisting relative? The paleontologist Hay, as a matter of fact, suggested as long ago as 1913, albeit in the course of a somewhat cursory survey, that he had noted some skulls referable to *B. occidentalis* "which might be looked upon as illustrating the transition from *B. occidentalis* to the existing American buffalo."[7]

The taxonomy, the morphological distinctions or relationships between the late Pleistocene bisons have never been examined with satisfactory thoroughness. Differences of opinion exist as to the relationship of these with the living form which can only be elucidated by more thorough anatomical and statistical studies than now exist. Perhaps, however, some of the assignments of southern limb fragments found with the Folsom culture are not valid in the light of hints of sizes ranging within *B. bison* specifications or not indicated at all. At all events the writer's purpose will be attained if this discussion leads to a more serious examination of the whole problem. The range, the intergradation of characters (if such exist) between *B. bison*, *B. bison athabascae*[8] and *taylori* should help greatly in clarifying a situation which has archeological as well as paleontological implications. Such a study, be it observed, will have to consist of more than the recording of the measurements of an occasional fine bull, of whatever species, and will have to take account of a possible progressive specific change which began earlier in the South.

LOREN C. EISELEY

THE UNIVERSITY OF KANSAS

UNFERMENTABLE REDUCING SUBSTANCES IN MOLASSES

WHEN pure invert sugar is heated at P_H 4.5 over a period of ten weeks at 55° C, a considerable quantity of material is formed which is not fermented by bakers' yeast. From the unfermentable residue of sugar thus treated we have isolated a product with the following properties: It is acid to litmus, soluble in water and glacial acetic acid, and it vigorously reduces both Fehling and Tollens solutions and gives no positive murexide test. It melts with decomposition at 226.5° C.

Quantitative analysis:

C 45.11 per cent. H 6.67 per cent. N 8.57 per cent.
P 3.79 per cent.

[4] Even the living species, as pointed out some years ago by Seton, in spite of its vast numbers was subject to enormous losses from prairie fires, floods and blizzards, which led Seton to comment that it could have done no more than hold its own in the struggle for survival. (Ernest Thompson Seton, "Life Histories of Northern Game Animals," Vol. I. Scribners. New York, 1909).

[5] A. O. Rhoad, "Climate and Livestock Production," *1941 Yearbook of Agriculture*, Washington, D. C., 1941, pp. 508–516.

[6] E. H. Barbour and C. B. Schultz, *Bulletin Nebraska State Museum*, 1: 435–436, 1936. Seton, *op. cit.*, p. 250. S. N. Rhoads, Proceedings of the Academy of Natural Sciences of Philadelphia. Vol. for 1897, pp. 499–500.

[7] O. P. Hay, *Proceedings of the U. S. National Museum*, 46: 176, 1913.

[8] S. N. Rhoads (*op. cit.*) expressed the view that *B. b. athabascae* was taxonomically intermediate between *B. bison* and the most recent fossil species.

An empirical formula based on these values is

$$C_{30}H_{54}O_{18}N_5P$$

We have found organic phosphorus in commercially available distillery slops concentrates which would seem to confirm the belief that the above compound is essentially a yeast product.

F. W. ZERBAN
THE NEW YORK SUGAR TRADE LABORATORY
LOUIS SATTLER
BROOKLYN COLLEGE

CONTRACT BETWEEN THE SHELL DEVELOPMENT COMPANY AND THE CONGRESS OF INDUSTRIAL ORGANIZATIONS

A SATISFACTORY contract has been consummated between the Shell Development Company, Emeryville, California, and the Federation of Architects, Engineers, Chemists and Technicians (CIO) (Chapter 25). The contract was signed on May 25, 1942, at the conclusion of a mediation hearing in Oakland before Paul A. Dodd, public associate member of the National War Labor Board and professor of economics at the University of California at Los Angeles.

The following statement was given by Mr. J. F. M. Taylor, president of the company, and Mr. Marcel Scherer, international vice-president of the Federation of Architects, Engineers, Chemists and Technicians:

> The signing of a collective bargaining contract indicates remarkable progress in collective bargaining in this field. We look forward to setting high standards in labor-management relations which will result in furthering Shell Development's contribution to the war effort.

Some 275 laboratory, engineering and pilot plant technicians of the company will benefit from this agreement, which establishes a contractual basis for hours, working conditions and wages. The company recognizes the federation as the sole bargaining agent for the employes covered by the contract.

The contract provides for promotions based on merit, layoffs based on seniority, and time-and-one-half payment for required overtime work. Employees are protected against arbitrary discharge. In cases of dismissals for general inefficiency or low standards of work, warnings are given a reasonable period in advance in order to afford the employee an opportunity to correct them. A clause on hiring states that no person shall be discriminated against because of race, color, creed, nationality, sex or religious belief. Among the economic benefits gained under the terms of this contract is the acceleration of the rate of advancement within the existing wage scales. The agreement contains a maintenance of membership clause whereby the company recognizes the obligation of employees who are now members or may become members of the Federation of Architects, Engineers, Chemists and Technicians, to maintain themselves in good standing in the union for the duration of the contract.

The outstanding and unique feature of the agreement is the inauguration of a patent bonus plan, the benefits of which will be shared equally by all employees of the company. This plan will undoubtedly stimulate inventions among the employees and thus contribute largely to the war effort.

At the conclusion of the hearing Professor Dodd stated:

> Because of the high intelligence and education of the negotiators on both sides of the table, it has struck me that this case is one of the most unusual cases to come before the War Labor Board. I am sure that the enlightened spirit which has prevailed at this conference table will be continued with a resulting satisfactory bargaining relationship.

DAVID E. ADELSON

THE STATURE OF MEN

IN the May 22, 1942, issue of SCIENCE there appeared a communication (on page 529) from S. L. Calhoun, of Leland, Mississippi, mildly scolding a collaborator and myself for our promulgation of a "false hypothesis." This correspondent writes in part as follows:

> Recent articles in SCIENCE have left the reader with a certain amount of skepticism as well as a large amount of thought-provoking data.
>
> In the December 12 issue of SCIENCE (Vol. 94, No. 2450, pp. 552–553) Leonard R. Rowntree gives an average height of over 2,000,000 registrants examined as 67½ inches, the identical average of men in World War I. An increase in weight of eight pounds was shown.

Your correspondent then goes on to cite an article written by Richard G. Canning and myself which appeared originally in *Human Biology*, Vol. 13, No. 4, pp. 533–540, December, 1941, and which was discussed in SCIENCE, Vol. 95, No. 2454, *Supplement*, p. 13, January 13, 1942. We had shown that freshmen in the University of Cincinnati had increased over two inches in average height from 1916 to 1936. We had generalized from our data that men were getting taller. It seems that we had no right to do this, for your correspondent says:

> These observations would lead one to conclude that childhood care and advantages, which result in increased growth, are much greater for those students in the University of Cincinnati than for the United States as a whole, and that any conclusions drawn by Chenoweth and Canning should be confined and not generalized.

I think the explanation of the difficulty is a simple one. I have before me Medical Statistics Bulletin No. 1, National Headquarters, Selective Service Sys-

tem, Washington, D. C., November 10, 1941. This bulletin was prepared by Lieutenant Oliver Harold Folk, chief, Medical Statistics Section, Research and Statistics Division, under the direction of Mr. Kenneth H. McGill, assistant chief, Research and Statistics Division, and in cooperation with Colonel Leonard George Rowntree, M.C., Res., chief, Medical Division. On page six there appears this statement:

> The average height of the registrants examined (by local draft boards) was 67.5 inches, the average weight 150 pounds and the average chest measurement at expiration was 33.9 inches. Registrants who were classed by local boards as available for general military service averaged 68.1 inches in height and weighed 152 pounds.

On page eight of this report there also appears this statement:

> While many obvious reasons make direct comparisons with data compiled in previous emergencies impossible, it is interesting to note that the average height of recruits examined during World War I was 67.5 inches, the average weight was 142 pounds, and the average chest measurement at expiration was 33.2 inches.

What happened in Colonel Rowntree's analysis was, I think, that he had compared (1) a group of 2,000,000 men examined by draft boards in World War II with (2) *recruits,* or the men accepted by the army for military service in World War I. It must be remembered that all those less than 64 inches are not eligible for military service and were probably excluded from group (2) above, but were included in group (1). Hence we do not have here two comparable groups. The reason I feel this to be true is that the report specifically stated that *recruits* were 67.5 inches tall and recruits, according to army definition, are men *accepted* for military service who have not been assigned to a specific duty. It is quite true that men over 78 inches tall were also rejected, but every one knows that there are many more under 64 inches than over 78 inches.

You will notice from the report that, "Registrants who were classed by local boards as available for general military service averaged 68.1 inches in height. . . ." I have an idea that when the army reexamined these "registrants" and made "recruits" of them the average height of the latter increased some more. When the final figures are released I shall be surprised if we do not learn that the soldier in the Army of the United States in this present war is about one inch taller than his father was in World War I, provided the standards of height remain the same for both wars.

LAURENCE B. CHENOWETH
DEPARTMENT OF HYGIENE,
STUDENTS' HEALTH SERVICE,
UNIVERSITY OF CINCINNATI

SCIENTIFIC BOOKS

THE LYMPHATIC SYSTEM

Lane Medical Lectures: The Lymphatic System. Its Part in Regulating Composition and Volume of Tissue Fluid. By CECIL K. DRINKER, professor of physiology and dean of the School of Public Health, Harvard University. 101 pages; 29 illustrations. Stanford University Publications, University Series. Medical Sciences, Volume IV, No. 2. California: Stanford University Press, Stanford University. London: Oxford University Press, Humphrey Milford. 1942. Paper, $1.50; cloth, $2.25.

DESERVING a place as a medical classic beside Sir Michael Foster's Lane Medical Lectures on the "History of Physiology," published 42 years ago, are Dr. Cecil K. Drinker's lectures on "The Lymphatic System," for these few pages offer a most significant general account of the system.

All the five lectures are based on one theme—how do the blood capillaries and the lymphatic capillaries cooperate to produce the environment necessary for the life of every single cell in the animal body? For this function, Dr. Drinker finds that there are five essential features of the vascular system in mammals.

1. A closed system of blood capillaries with endothelial walls of varied permeability but capable of retaining practically all of the blood plasma during the usual conditions of rapid capillary transit.

2. A variable hydrostatic pressure in the capillaries.

3. A mixture of extracellular non-respiratory proteins in the blood to which the capillary endothelium is somewhat permeable.

4. An extravascular tissue fluid, lower than the blood plasma in content of blood proteins but in other respects practically identical with plasma.

5. A system of closed lymphatic capillaries with extremely permeable endothelial walls, which lacks any inherent propulsive mechanism to move lymph into larger valved vessels but is dependent upon inconstant and extraneous forces, such as those of muscular activity or massage, to cause entrance of fluid, cells, and particles into lymphatic capillaries and eventual flow of lymph back to the blood.

In the light of these characteristics which, in their entirety, are limited to the blood and lymph vessels of mammals, Dr. Drinker follows the changes in the environment of cells, from the very simplest forms for which sea water constitutes the external environment, through one shift or another in the animal kingdom—not in any sense through an orderly progression

—until in mammals all cells live in an internal environment. This makes a fascinating story.

There follows an account of the history of knowledge of the vascular system, written as one has longed to have medical history recorded. In these pages familiar discoveries are lived through again but, more than that, there is the continued logical story of the ideas they evoked—the history of medical thought.

It was a favorite saying of the late Professor Franklin Paine Mall that one ought to get just as much pleasure out of the discoveries of others in one's field as from one's own work. He would have found that quality of pleasure in Dr. Drinker's pages.

In Chapter IV is concentrated the story of the physiology of the lymphatic capillaries. It starts with the work of Carl Ludwig and his pupils. They succeeded in cannulating not only the thoracic duct but the peripheral lymphatic trunks as well. From his studies Ludwig believed that lymph was a filtrate from the blood, a concept later extended and established by Starling (1893) in a study of the influence of mechanical factors on lymph production. From this foundation further progress has depended on the development of exceptional skill in operative procedures, aided by the new binocular dissecting microscopes, adequate lighting facilities and tools perfectly adapted to their use. In addition, an essential factor in the advancement of knowledge in this field was the introduction (started in 1920) of microchemical methods which allowed for the first time repeated analyses of lymph from the same vessel.

By means of extensive experiments, notably by Dr. Drinker and his collaborators, on cannulating peripheral lymph channels, it has been demonstrated that in the entirely quiescent state there is practically no flow of lymph. This is expressed in the fifth generalization quoted above, that the lymphatics in the mammal have no inherent propulsive mechanism for moving the lymph.

The importance of this physiological fact is shown in its applications to medicine and surgery in the last chapter. There followed the even more remarkable achievements of cannulating the ducts draining the heart and the lungs. The studies on the lungs[1] were in press when the present Lane Lectures were being written. From both heart and lungs there is a considerable flow of lymph, relatively constant for each animal. Neither heart nor lungs are ever quiescent. Over-ventilation of the lungs reduces lymph flow and, conversely, lowered oxygen, by increasing the permeability of the blood capillaries, increases lymph flow. From the lungs, a single lymphatic duct on the right side drains the right lung and much more than half of the left lung, but from the heart, on the other hand, it is possible to collect all the lymph. Analyses of the lymph from the heart and of the pericardial fluid show such correlation in composition with serum as to demonstrate conclusively that both lymph and pericardial fluid are filtrates from the blood.

Based on the knowledge gained from extensive experiments on lymph flow and the conditions which affect it, is such an illuminating discussion (in the fifth chapter) on the mechanisms of wound healing and scar formation in relation to the newer methods for treating injuries that no surgeon can afford to miss it.

At the time Dr. Drinker was invited to deliver the Lane Medical Lectures for 1941, he was engaged in correcting proof of his recent book[2] which gives a detailed, critical analysis of the entire subject and an extensive bibliography. This invitation gave him a chance for a different type of contribution. These are days of high specialization in science, but the type of problem that must now be faced demands not one but often many of these special techniques. Books of the type of the present one, which give the story of the nature of a problem and of the balance of theory and experiment, are thus urgently needed by scientists themselves. Written in clear, lucid, nontechnical language, these pages will prove a delight to the layman interested in biology, to the medical student keen to see what the adventure of research is like, and to the practitioner, still a student of medicine.

FLORENCE R. SABIN

ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH,
NEW YORK, N. Y.

[1] Madeleine F. Warren and Cecil K. Drinker, *Amer. Jour. Physiol.*, 136: 207, 1942.

[2] C. K. Drinker and J. M. Yoffey, "Lymphatics, Lymph and Lymphoid Tissue." Cambridge, Mass.: Harvard University Press, 1941.

A MODERN WIZARD

Doctor Wood: Modern Wizard of the Laboratory. By WILLIAM SEABROOK. 335 pp. New York: Harcourt, Brace and Company. 1941. $3.75.

THOSE who have known Dr. Wood for many years will doubtless read with much enjoyment, not to say amusement, this very interesting biography. In it they will find many verifications of their own experiences and many additions to those experiences. Naturally, it is impossible to give anything like a detailed review of a book which is saturated with anecdotes and in which the details of the special situations concerned are the things which provide the main features of entertainment.

The biography starts with a legendary letter supposedly written by Robert Williams Wood to his grandmother on the day he was born and announc-

ing his intention of paying his respects to the said grandmother in due course. Chapter I introduces us to some of his boyhood pranks, which read much more amusingly when the dangers and embarrassments associated with them are known to have passed. In Chapter 2 we trace his four years at Harvard, we breathe a sigh of relief at the evident intervention of Providence which prevented him from blowing up the chemical laboratory, we find him transporting himself into the realms of fantasy through an effort to enlarge his experience by swallowing a suitable quantity of oriental drugs and thus transforming himself in his own imagination into a fox, and finally we see him safely graduated in 1891, to the relief and surprise, as it is recorded, of his family and probably some of the faculty as well, many of whom, it is confessed, he must have infuriated beyond words. In the third chapter we find him at Johns Hopkins with the idea of securing a Ph.D. degree. We see him spitting out metallic sodium into street puddles to the great consternation of the darkies who, seeing him thus spit that which turns to fire, believed him to be a reincarnation of the devil himself. We read of his courtship of the future Mrs. Wood and of its practical turn in devising a specialized form of hot water bottle, depending upon a mixture of sulfuric acid and water, for the purpose of keeping her hands warm. We find him leaving Johns Hopkins without the degree for which he went there and going to the University of Chicago, where we learn of his grievances in the laboratory of Professor E. H. Schneider, from whom, however, he parted without mortality on either side. He completes his thesis for his Ph.D. degree in chemistry, but changes in the requirements in physics prevent him from completing that degree and result in his leaving in high dudgeon. Next we find him in Berlin where, as a result of some of his pranks, only his legs save him from official incarceration as a guest of the government. We find him trying out everything, including gliding, and nearly breaking his neck in the process. In 1897 he assumes the academically humble and poorly paid post of junior instructor of physics at the University of Wisconsin, where, however, advancement comes to him for his ingenious exploit in using the city's electric power supply to thaw out the city's water mains in winter. Later, in the same university, we find him beginning some of the spectroscopic work for which he was to become so famous.

Following the death of Henry Roland in 1901, Wood became professor of experimental physics at Johns Hopkins University where, supplemented by the work performed at his summer laboratory at East Hampton, he continued to enhance his reputation so well established in optics. The narrative is filled with anecdotes pertinent to this period, one of the most celebrated being that concerned with the cleaning of cobwebs from the interior of his long spectroscope, which action was performed by driving the family cat through the tube, a procedure which, as one might surmise, he did not fail to publish in the *Philosophical Magazine*. We read of his trips to Europe, of his subtle tiffs with certain Continental physicists and of his dramatic and perhaps a little hard-hearted procedure of exposing the myth of Blondlot's N-rays. We read of the background surrounding his humorous writings, notably his celebrated book "How to Tell the Birds from the Flowers." The war period is covered, and one senses that Wood's temperament was evidently not very well adapted to military procedures. We read of his exploits in the debunking of frauds and of his driving the celebrated medium, Margery, into hysterics. We learn of his exploits in the capacity of a scientific detective and of his solution of several criminal mysteries. Finally, we learn of his exploits as a boomerang thrower and of his confidence of his own skill in hurling a war boomerang right at the spectators of a football match, happily without fatality.

All in all, the book will provide entertaining reading for any one and particularly for those who have known Dr. Wood in the flesh and who, of their own experience, can enhance the setting of some of the amusing stories told.

W. F. G. SWANN

BARTOL RESEARCH FOUNDATION OF
THE FRANKLIN INSTITUTE

SOCIETIES AND MEETINGS

THE IOWA ACADEMY OF SCIENCE

THE fifty-sixth annual meeting of the Iowa Academy of Science was held at Iowa Wesleyan College, Mt. Pleasant, Iowa, on April 17 and 18, with 195 registered members and visitors attending. The academy was officially welcomed to the Iowa Wesleyan campus by President Stanley B. Niles, who at the same time reviewed the history, accomplishments and objectives of Iowa Wesleyan College, which was celebrating the centenary of its founding. The presidential address by President Roy A. Nelson, of Cornell College, following the welcome, ably developed the topic "Science in a Changing World." Then Dr. Walter F. Loehwing, of the State University of Iowa, presented an interesting discussion of the physiology of plant growth and development.

A joint symposium on industrial hygiene was held with the Iowa Medical Society on Friday afternoon.

The topic "Industrial Hygiene Problems in Iowa" was discussed by Dr. Paul J. Houser, director of hygiene, Iowa State Department of Health; "Air-Borne Infection," by Dr. Roland Rooks, of the Department of Hygiene and Preventive Medicine, State University of Iowa. There were 128 paid admissions to the academy dinner on Friday night. After dinner Dr. Thomas F. Vance, of Iowa State College, made a sparkling address on "Sense and Nonsense Amid the Scientific." The academy address of Friday night was delivered by Dr. George E. Stoddard, of the State University of Iowa, on the subject "New Light on Intelligence," a review of recent work on the "Nature-Nurture" problem.

The academy met as usual in sections on Friday afternoon and Saturday morning to listen to the presentation of 123 papers. Three of these papers appeared in the symposium of the Science Teaching section. The speakers and subjects were as follows: E. W. Lindstrom, Iowa State College, "Teaching to Think *in* a Field Rather than *about* It"; W. H. Bragonier, Iowa State College, "The Use of the Standard Partial Regression Coefficient in Constructing General Botany Achievement Tests"; W. F. Loehwing, State University of Iowa, "Teaching of General Botany—Appraisal and Forecast."

The 1943 meeting will be held at Cedar Falls, Iowa, on the third Friday and Saturday of April. The officers and section chairmen for the new year are as follows: *President,* C. W. Lantz, Cedar Falls; *Vice-President,* E. R. Smith, Ames; *Secretary-Treasurer,* E. R. Becker, Ames; Editor, L. R. Wilson, Cedar Rapids; botany, W. E. Loomis, Ames; chemistry, general and physical, D. L. Deardorff, Mt. Pleasant; chemistry, organic and biological, F. B. Moreland, Iowa City; geology, E. J. Cable, Cedar Falls; mathematics, N. B. Conkwright, Iowa City; physics, L. T. Earls, Ames; psychology, H. F. Brandt, Des Moines; science teaching, Karl A. Stiles, Cedar Rapids; zoology, Leland P. Johnson, Des Moines.

E. R. BECKER,
Secretary

AMES, IOWA

REPORTS

REGULATIONS CONCERNING LABORATORY EQUIPMENT

THE Division of Industry Operations of the War Production Board has issued the following regulations in regard to the manufacture and use of laboratory equipment:

Because of the critical shortage of scientific equipment, university and other private laboratories engaged in research work unrelated to the production of materials, or in other research not directly connected with the war effort, will be unable to secure new laboratory equipment unless the particular use is approved by the Director of Industry Operations.

This is the result of Limitation Order L–144, issued to-day (June 12). The order prohibits the sale and delivery of laboratory equipment except for certified essential uses in order to save highly critical materials and to make certain that such equipment will be available for vital war purposes.

In addition to making special provision for the handling of requests for equipment for uses not specifically permitted, the order permits any laboratory or other user to obtain repair parts and operating supplies for maintenance of existing equipment and activities.

The regulations, which will affect 600 manufacturers and 3,000 laboratories, prohibit the sale, delivery, renting or purchase of laboratory equipment in which any of the following materials are contained: aluminum, chromium, copper, iron, magnesium, molybdenum, nickel, steel, tantalum, tin, titanium, any alloy of these metals, rubber, any synthetic rubber, or non-cellulose base synthetic plastics.

In order to buy or sell laboratory equipment containing the above materials, a certification must be made by a duly authorized official of the purchasing company or laboratory stating that the equipment will be used only for one of the following purposes:

1. Research on, or analysis of, materials.
2. Research by or for Government agencies or "Lend-Lease" countries.
3. For training of personnel for the Army and Navy or other Government Departments or "Lend-Lease" countries.
4. To the extent necessary for the replacement of essential existing equipment in laboratories affecting the public health, and in Federal, State and local government laboratories.
5. To the extent necessary for repair parts and operating supplies for maintenance of existing essential equipment and activities in laboratories.
6. For any use which the Director of Industry Operations determines necessary and appropriate in the public interest.

Determinations of the uses which will be permitted under item (6) will be made by E. R. Schaeffer, Chief of the Safety and Technical Equipment Branch, acting for the Director of Industry Operations. Mr. Schaeffer has been named Administrator of the L–144 Order, and authorized to approve, after consultation with the Army and Navy Munitions Board, further uses of laboratory equipment which may be necessary.

Manufacturers will obtain the necessary amounts of critical materials for purposes permitted by the order by filing PD–25A applications under the Production Requirements Plan. Distributors, wholesalers and jobbers

needing priority assistance should file PD–IX forms with the Distributors Branch of the War Production Board.

TITLE 32—NATIONAL DEFENSE
CHAPTER IX—WAR PRODUCTION BOARD
SUBCHAPTER B—DIVISION OF INDUSTRY OPERATIONS
PART 1261—LABORATORY EQUIPMENT
LIMITATION ORDER L–144

The fulfilment of requirements for the defense of the United States has created shortages in the supplies of Laboratory Equipment and the materials entering into the manufacture thereof for the war effort, for private account and for export; and the following Order is deemed necessary and appropriate in the public interest and to promote the national defense:

Section 1261.1—GENERAL LIMITATION ORDER *L–144.*

(a) *Definition.* For the purpose of this Order:

"Laboratory Equipment" means material, instruments, appliances, devices, parts thereof, tools and operating supplies for laboratories, or for use in connection with operations usually carried on in laboratories, not including second-hand items.

(b) *General Restrictions.*

(1) No Person shall sell, deliver, rent, purchase, acquire or accept delivery of Laboratory Equipment in which there is incorporated or used aluminum, chromium, copper, iron, magnesium, molybdenum, nickel, steel, tantalum, tin, titanium, any alloy of said metals, rubber, neoprene or other synthetic rubber, or non-cellulose base synthetic plastics, except pursuant to a purchase order or contract having certified thereon a statement in the following form, signed manually, or as provided in Priorities Regulation No. 7, by an official duly authorized for such purpose:

"Certification

The Laboratory Equipment herein ordered will be used or sold in conformity with the provisions of General Limitation Order No. L–144, with the terms of which the undersigned is familiar.

Name .....

By .....

Signature of duly authorized official"

(2) No person shall make the Certification described in the foregoing paragraph unless the Laboratory Equipment purchased or contracted to be purchased is for one or more of the following uses:

(i) Research on, or production, analysis or testing of, materials.

(ii) Research by or for the United States Army, Navy, Maritime Commission, or any other department, or agency of the government of the United States, or of any foreign country entitled to deliveries under the Act of Congress of March 11, 1941, "An Act to Promote the Defense of the United States" (Lend-Lease Act).

(iii) Training of personnel for the United States Army, Navy, Maritime Commission, or any other department of the United States, or for the government of any foreign country entitled to deliveries under the Act of Congress of March 11, 1941, "An Act to Promote the Defense of the United States" (Lend-Lease Act).

(iv) To the extent necessary for the replacement of essential existing equipment in laboratories affecting the public health, and in United States government, state, county, and municipal laboratories.

(v) To the extent necessary for repair parts and operating supplies for the maintenance of existing essential equipment and activities in laboratories.

(vi) For any use which the Director of Industry Operations, War Production Board, determines is necessary and appropriate in the public interest.

(3) Said Certification shall constitute a representation to the War Production Board and to the person with whom the purchase order or contract is placed that the subject matter of the order or contract will be used or sold in accordance with the provisions of this Order. Every person concerned shall be entitled to rely on said Certification, unless he knows or has reason to believe it to be false.

(4) No manufacturer shall use any scarce material described in foregoing paragraph (b) (1), where and to the extent that the use of other material is practicable.

(c) *Applicability of Priorities Regulation No. 1.* This Order and all transactions affected thereby are subject to the provisions of Priorities Regulation No. 1 (Part 944) as amended from time to time, except to the extent that any provision hereof may be inconsistent therewith, in which case the provisions of this Order shall govern.

(d) *Records.* All persons to whom this Order applies shall keep and preserve for not less than two years, accurate and complete records concerning inventories, production and sales, including copies of each purchase order or contract containing the certification hereinabove referred to.

(e) *Audit and Inspection.* All records required to be kept by this Order shall, upon request, be submitted to audit and inspection by duly authorized representatives of the War Production Board.

(f) *Reports.* All persons affected by this Order shall execute and file with the War Production Board such reports and questionnaires as said Board shall from time to time request.

(g) *Violations.* Any person who wilfully violates any provision of this Order, or who, in connection with this Order, wilfully conceals a material fact or furnishes false information to any department or agency of the United States is guilty of a crime, and upon conviction, may be punished by fine or imprisonment. In addition, any such person may be prohibited from making or obtaining further deliveries of, or from

processing or using, material under priority control and may be deprived of priorities assistance.

(h) *Appeal.* Any person affected by this Order who considers that compliance herewith would work an exceptional and unreasonable hardship upon him, may appeal to the War Production Board setting forth pertinent facts and the reasons such person considers that he is entitled to relief. The Director of Industry Operations may thereupon take such action as he deems appropriate.

(i) *Communications.* All reports required to be filed hereunder, or communications concerning this Order, shall, unless otherwise directed be addressed to:

"War Production Board
Safety and Technical Equipment Branch
Technical and Scientific Equipment Section
Washington, D. C. Ref: L–144"

Issued this 12th day of June, 1942.

J. S. KNOWLSON,
Director of Industry Operations

SPECIAL ARTICLES

EFFECT OF ORCHIDECTOMY ON SKELETAL METASTASES FROM CANCER OF THE MALE BREAST

A SYSTEMATIC study is in progress of the effects of induced hormone imbalance on the course of primary inoperable and metastatic breast cancer in both sexes. Among the procedures employed have been: (1) castration by irradiation of the ovaries; (2) bilateral oophorectomy; (3) the parenteral administration of limited amounts of estradiol monobenzoate; (4) the parenteral administration of testosterone propionate.

The immediate elevation of the serum calcium and subsequent radiographic evidence of extension of the skeletal metastases have been reported[1] in three female patients who received 400 to 500 mgms of testosterone propionate over periods of from 7 to 10 days. A fourth patient (Case I), a male with osseous metastases from a cancer of the breast, received 925 mgms of testosterone proprionate in 17 days. The only subsequent chemical abnormality observed was a slight elevation of the serum calcium level to 11.7 mgms. Measured radiographically, however, the metastatic lesions increased rapidly in number and extent. Pathological fractures of the humeri and vertebrae occurred before death 10 months after treatment.

From the evidence it was concluded that a steroid hormone imbalance due to the administration of testosterone propionate not only failed to inhibit the progress of metastatic mammary cancer but seemed to accelerate the activity of the growth in both sexes.

The effect of surgical castration on the osseous metastases from inoperable mammary cancer has been studied in a male of 72 years (Case II). Bilateral orchidectomy was performed in February, 1942. In the four months since operation evidence which suggests a regression of the growth has come to hand. The ulcerated lesion of the left breast has decreased in diameter from $7 \times 4 \times 2$ cm to $5 \times 3 \times 1.5$ cm. There has been complete relief of bone pain, previously a persistent and troublesome manifestation. Radiographic evidence indicates that the areas of decalcification, representing metastatic deposits of cancer in the ribs, vertebrae and scapula, have shown no increase in extent. Furthermore, in these areas an increased density has appeared, interpreted as a reflection of increased calcification and healing of the lesion. No chemical alteration was noted beyond a recent elevation of the serum alkaline phosphatase (5.9 to 11.1 units).

The rates at which estrogenic substance and 17 ketosteroid were excreted in the urine of these 2 patients were estimated before and after treatment (Case I—testosterone, Case II—orchidectomy). The results are given in Table 1.

TABLE 1

CASE I		
	Estrogens	Androgens
1/12–15/40	34.0 M.U.	44.5 mgms.
1/15 /40	Daily injections of 50 mgms. testosterone propionate begun	
1/15–18/40	34.0 M.U.	40.9 mgms.
1/18–21/40	22.0 M.U.	41.8 mgms.
1/21–24/40	50.0 M.U.	56.7 mgms.
CASE II		
	Estrogens	Androgens
2/ 6– 9/42	22.5 M.U.	11.7 mgms.
2/ 9 /42	Bilateral orchidectomy	
2/13–16/42	16.7 M.U.	3.0 mgms.
2/23–26/42	8.6 M.U.	12.0 mgms.
3/ 9–12/42	13.3 M.U.	8.7 mgms.
4/ 1– 4/42	Trace (less) than 4 M.U.	10.2 mgms.

The decrease in estrogen excretion after orchidectomy as well as a stable 17 ketosteroid output are striking features. Control of disease as extensive as that observed in Case II is unusual. It may be unassociated with the operative procedure employed, although this appears improbable.

JOSEPH H. FARROW
FRANK E. ADAIR

THE MEMORIAL HOSPITAL,
NEW YORK, N. Y.

[1] J. H. Farrow and H. Q. Woodard, *Jour. Am. Med. Asn.*, 118: 339–343, January 31, 1942.

FEATHER DEPIGMENTATION AND PANTOTHENIC ACID DEFICIENCY IN CHICKS

DEPIGMENTATION of the hair due to deficiency in the filtrate fraction of the vitamin B_2 complex has been demonstrated in rats, dogs and foxes.[1] Similar graying has been reported[2] in rats on a diet low in pantothenic acid. In order to determine whether these deficiencies produce depigmentation in the feathers of birds, fifty-nine Black Minorca chicks, one week of age, were placed on a purified, vitamin-free diet similar to that used by Almquist.[3] In addition, the following crystalline vitamin supplements were given daily by pipette to each chick: 100 micrograms each of riboflavin and thiamin chloride and 50 micrograms each of pyridoxine and nicotinic acid.[4] Vitamins A and D as liver oil were added directly to the diet. Forty-seven chicks received daily in addition to the above supplements 5 micrograms of calcium pantothenate or an amount of yeast extract containing this amount of pantothenic acid as determined by microbiological assay. The yeast extract was made from brewers' yeast extracted with acetone and treated with fuller's earth. Twenty-one chicks as positive controls received 280 micrograms of calcium pantothenate or its equivalent in assayed yeast extract. The average weight of the birds at the beginning of the experimental period was 60 grams. The average weight increase over the 66-day experimental period was 46 grams for the chicks on low pantothenic acid and 151 grams for the birds on high pantothenic acid supplements.

Feather samples taken from the chicks on the low pantothenic acid supplements on the sixteenth day of the experiment showed definite areas of partial depigmentation in both shafts and barbs with some distortion of the shafts and loss of barbules. Such areas were particularly striking in the primary feathers of the wing. Feathers of the group on high pantothenic acid supplements showed little or none of this depigmentation or distortion.

On the thirtieth day, depigmentation was most evident in the newly developed feathers of the ventral and femoral tracts in the low pantothenic acid group. In four of the birds on high pantothenic acid supplements, depigmentation of a lesser degree was noted. The entire group on low pantothenic acid appeared much lighter in color than the positive controls. It was clear that a high level of either calcium pantothenate or yeast extract protected against this distortion and depigmentation of the feathers, whereas the low levels of either, while allowing the birds to grow slightly, did not prevent feather changes.

The depigmentation was manifested microscopically as both a reduction in size of pigment granules and in numbers of these granules. The loss of barbules produced a barring effect particularly evident in the feathers of the femoral tract.

Eight chicks (average weight, 104 gm) receiving the low pantothenic acid supplements and nine (average weight, 212 gm) receiving the high pantothenic acid supplements were killed at the conclusion of the experimental period and tissue samples of liver, kidney, leg muscle and brain were assayed[5] for pantothenic acid by the microbiological method of Pennington, Snell and Williams.[6] The results of this assay are given in Table I.

TABLE 1

	P. A. intake daily	Liver	Kidney	Muscle	Brain
Aver. and range of P. A. content per mg. tissue	Adequate	53.6[51.7–55.7]	34.5[33.3–36.3]	11.6[10.7–13.8]	22.7[19.8–27.9]
	Low	40.9[37.5–44.4]	31.1[23.2–39.1]	3.3[2.7– 3.9]	8.9[7.5–10.3]

It is evident that the pantothenic acid content of the kidneys and to a lesser degree the livers of the deficient chicks was only a little less than that of the controls and that the greatest differences were present in the brain and muscle. This is not completely in agreement with Snell, Pennington and Williams,[7] who found that all the tissues of their deficient chicks were considerably lower than those of their positive controls.

The depigmentation phenomenon may be due wholly to pantothenic acid deficiency or some other factor may also be involved. In another experiment on a new group of fourteen chicks, the attempt was made to discover whether the feather depigmentation and distortion were solely a vitamin deficiency effect or

[1] A. F. Morgan, H. G. Davison and B. B. Cook, *Jour. Nutrition*, 15: 27, 1938; A. F. Morgan and H. D. Simms, *Jour. Nutrition*, 19: 133, 1940.

[2] K. Unna, G. V. Richards and W. L. Sampson, *Jour. Nutrition*, 22: 553, 1941.

[3] H. J. Almquist and E. Mecchi, *Proc. Soc. Exper. Biol. and Med.*, 48: 526, 1940.

[4] We are grateful for gifts of crystalline pyridoxine and of calcium pantothenate from Merck and Company, Rahway, New Jersey.

[5] We are indebted to Relda Cailleau for these microbiological assays.

[6] D. Pennington, E. E. Snell and R. J. Williams, *Jour. Biol. Chem.*, 135: 213, 1940.

[7] E. E. Snell, D. Pennington and R. J. Williams, *Jour. Biol. Chem.*, 133: 559, 1940.

resulted partly from inanition. All the chicks in both high and low pantothenic acid-supplemented groups were forced-fed the same amounts of food each day. This was unsuccessful as growth ceased entirely in the chicks on the low pantothenic acid level, and nearly all of them died after two weeks.

THOMAS C. GROODY
MARY E. GROODY
THE MUSEUM OF VERTEBRATE ZOOLOGY, AND
THE DEPARTMENT OF HOME ECONOMICS,
UNIVERSITY OF CALIFORNIA, BERKELEY

IDENTIFICATION OF SELENIUM INDICATOR SPECIES OF ASTRAGALUS BY GERMINATION TESTS

INDICATOR plants belonging to the genus *Astragalus* are of great aid in locating seleniferous areas that may be capable of producing toxic forage and grain.[1] From chemical analyses of plants collected in the field, 28 species of *Astragalus* are known to be selenium accumulators and indicators, whereas 54 other species of *Astragalus* absorb only small amounts of selenium and are not limited to seleniferous soils.[2] It is important that many of the remaining 218 species in North America and 1,200 species in the rest of the world be examined for their ability to absorb selenium.

The present paper describes a simple test with germinating seedlings that enables one to determine whether or not a given species of *Astragalus* is capable of accumulating selenium. The test is based on an earlier observation that a selenium indicator species tolerates and is even stimulated by a high concentration of sodium selenite, whereas a non-indicator species is severely poisoned by a low concentration of this salt.[3] No other case has been reported in which closely related species differ so markedly in their response to a mineral poison.

It has been found that the addition of 20 parts per million of selenium (as sodium selenite) to the culture solution has no observable effect upon the early seedling growth of an indicator species of *Astragalus*, whereas it completely inhibits root development of a non-indicator species.

The culture technique is an adaptation of a method that has been used for many years.[4] Seeds of most of the species included in these tests were collected during the summer of 1941. To soften their coats, the seeds were treated for from 30 to 60 minutes with concentrated sulphuric acid. They were then soaked in tap water for three hours and subsequently allowed to germinate on wet filter paper in a glass moist chamber. After about 24 hours, when the seedlings were approximately 10 mm in length, they were transferred to culture vessels. A piece of paraffined bobbinet (1/16-inch mesh) was stretched over the top of a 300-cc beaker and fastened by a ligature of paraffined linen thread. This beaker was placed in a 600-cc beaker, and both the inner beaker and the space around it were filled to the level of the netting with culture solution. Twenty-five seedlings were placed upon the netting, with their roots dipping into the solution. Two cultures of each species of *Astragalus* were prepared, one supplied with the usual mineral salts[5] and the other receiving in addition 20 parts per million of selenium (as sodium selenite). The cultures were kept in darkness at 28°–29° C., and a moist chamber was provided for each during the first day by covering the larger beaker with an inverted watch glass. At the end of three days, the seedlings were put in chrom-acetic fixing solution, and the lengths of roots and hypocotyls were later recorded. I am indebted to Dr. Sydney S. Greenfield for assistance in making these tests.

The results are summarized in the following tabulation, in which a *plus* sign signifies a selenium indicator species and a *minus* sign denotes a non-indicator species. The roots of the indicator species made the same amount of growth (25–30 mm) in the absence of selenium and in the presence of 20 parts per million. Root growth of the non-indicator species was completely inhibited in the solution containing 20 parts per million of selenium but amounted to 25–30 mm in the selenium-free solution. The hypocotyls of the non-indicator species in the selenium solution grew only about 5 mm, while those of all the other cultures grew 20–30 mm.

BISULCATI
+ *Astragalus bisulcatus* (Hook.) Gray (Wyoming)
+ *A. haydenianus* Gray (Colorado)
+ *A. oocalycis Jones* (Colorado)
GALEGIFORMES
+ *A. racemosus* Pursh (South Dakota)
– *A. drummondii* Hooker (Wyoming)
LONCHOCARPI
+ *A. osterhoutii* Jones (Colorado)
– *A. lonchocarpus* Torr. (New Mexico)
OCREATI
+ *A. confertiflorus* Gray (Utah)
+ *A. flavus* Nutt. (Wyoming)
PODO-SCLEROCARPI
+ *A. grayi* Parry (Wyoming)
+ *A. pectinatus* Dougl. (Wyoming)
+ *A. rafaelensis* Jones (Utah)
+ *A. toanus* Jones (Nevada)
– *A. canonis* Jones (California)

[1] For a general review of the selenium problem, see: S. F. Trelease, *The Scientific Monthly*, 54: 12, January, 1942.

[2] O. A. Beath, C. S. Gilbert and H. F. Eppson, *Am. Jour. Bot.*, 28: 887, 1941.

[3] S. F. Trelease and H. M. Trelease, *Am. Jour. Bot.*, 26: 530, 1939.

[4] S. F. Trelease and H. M. Trelease, *Bot. Gaz.*, 80: 74, 1925.

[5] See footnote 3.

– *A. casei* Gray (California)
– *A. pterocarpus* Watson (Nevada)
– *A. sclerocarpus* Gray (Washington)
– *A. tetrapterus* Gray (Nevada)
PREUSSII
+ *A. beathii* Porter (Arizona)
+ *A. pattersonii* Gray (Colorado)
+ *A. praelongus* Sheld. (New Mexico)
+ *A. preussii* Gray (Utah)
INFLATI
– *A. lentiginosus* var. *palans* Jones (Arizona)
SARCOCARPI
– *A. crassicarpus* Nutt. (Wyoming)
ULIGINOSI
– *A. canadensis* var. *carolinianus* (L.) Jones (Wyoming)

The group names in the list are those into which Jones[6] divided the genus on the basis of morphological characters. Using the criterion of physiological differentiation with reference to selenium, it is evident that the groups Galegiformes, Lonchocarpi and Podo-sclerocarpi need taxonomic revision, since each includes both indicator and non-indicator species.

The results of these germination tests are in agreement with those of field observations and growth experiments of longer duration.

SAM F. TRELEASE
LABORATORY OF PLANT PHYSIOLOGY,
COLUMBIA UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

REARING GRASSHOPPERS UNDER LABORATORY CONDITIONS[1]

THE rearing of grasshoppers in the laboratory requires considerable care and attention.[2] The food must be grown and supplied daily to the insects, the cages must be cleaned at least once a week, dampness must be avoided, etc.

The present paper describes a simple method for rearing grasshoppers which is being used in the Division of Entomology and Economic Zoology of the University of Minnesota.

Two types of cages are used, a smaller, for the hatching of the eggs and as living quarters for the first instars, and a larger one for growth and reproduction.

Inside dimensions of the smaller cage are $6 \times 3\frac{1}{2} \times 3\frac{1}{2}$ inches. The sides and one of the ends are of wooden boards, the other end is left open for the attachment of a cheesecloth sleeve. The top and the bottom of the cage are made of screen wire cloth, 16 to an inch mesh. The bottom is elevated a quarter of an inch above the surface of the table.

The larger cage is of $12 \times 12 \times 12$ inches inside dimensions. The cage is made of wire cloth 12 to an inch mesh, nailed to the wooden framework. The bottom is elevated a half of an inch above the surface of the table. The lower third of one side is left open for a cheesecloth sleeve as in the smaller cage.

Food consists of a dry mixture of dried brewers' yeast, 1 part; skim milk powder, 2 parts; and dried alfalfa meal, 2 parts by weight. Water is given in shell vials plugged with cotton and laid on the bottom of the cage. Food can be supplied to the newly emerged insects in "Coca Cola" or similar caps from which cork has been removed. It is advisable to put 2 to 3 receptacles with food in the cage as well as 2 or 3 vials of water in order to avoid overcrowding and consequent undernourishment of some insects. One ounce ointment boxes are satisfactory for food containers in the bigger cage.

Grasshoppers are allowed to emerge from the eggs in the small cage. Water and food should already be present before hatching starts. Constant light is provided by bending an ordinary table lamp over the cage—about 3 to 4 inches from the top screen. The insects find the food and water without difficulty. It is important, however, to have the insects reared from eggs in the cage and not to introduce them from the outside after they will already have started feeding on their natural food. After all the insects enter their second instar, they may be transferred to a larger cage, the dimensions of which depend on the number of grasshoppers maintained for use in the laboratory.

The insects do not require any special attention, provided they always have food and water available. Feces which accumulate under the screen bottom may be removed from time to time.

In our experiment, hatching of overwintering eggs of *Melanoplus differentialis* started on May 27 and next molt occurred 5 days later. June 7, when all the grasshoppers had molted, they were transferred to the larger cage. There was no mortality. The time of appearance of the nymphs of the third instar was not noted, but June 9 the nymphs of the fourth instar began to appear, and succeeding molts occurred on June 13 and 20. The first adults appeared on June 24, the total developmental period being 28 days after hatching, during which 6 molts occurred. July 11, the last nymph molted, 31 days after hatching started. The insects were mostly segregated in a circle around the light where the temperature was about 34° C.

[1] Paper No. 1938, Scientific Journal Series. Minnesota Agricultural Experiment Station, St. Paul, Minn.

[2] E. E. Carothers, "Culture Methods for Grasshoppers. Culture Methods for Invertebrate Animals," pp. 287–291. Comstock Publishing Company, Ithaca, N. Y. 1938.

[6] M. E. Jones, "Revision of North American Species of *Astragalus*." 1923.

First death of adults occurred on July 12, 45 days after hatching, and 43 days later half of the adults were dead. The last adult, a male, died on October 26 at the approximate age of 152 days. Until July 31 the insects were kept in a basement laboratory having only artificial light available day and night. On that day the cage was taken to the greenhouse, where it remained till the end of the experiment. The insects behaved normally. They mated and the females oviposited in sod which had been placed on the floor of the cage.

The advantages of this method are obvious. The experimenter needs only to fill the dishes with food when necessary, provide water and occasionally remove the paper with feces from under the cages.

MYKOLA H. HAYDAK

UNIVERSITY FARM,
UNIVERSITY OF MINNESOTA

VITAMIN SYNTHESIS BY A YEAST CONVERTED FROM A HETEROTROPHIC TO AN AUTOTROPHIC HABIT[1]

Saccharomyces cerevisiae is generally accepted to be heterotrophic with regard to a number of vitamins. However, the writers have succeeded in inducing ten strains of this yeast to grow without an exogenous supply of thiamin, pyridoxin, inositol and pantothenic acid; in addition, a rich growth without even biotin has been induced in the case of at least one strain. Thus has evolved a yeast that will readily grow in a synthetic medium containing no vitamins. This building-up process of autotrophic habit was accomplished by means of prolonged incubation, by the use of a large quantity of inoculum during the initial stages and by successive transfers to solutions from which one of the essential vitamins was omitted. Ordinarily from four to seven passages sufficed to induce the yeast to grow as well in the absence of a given vitamin as it did in its presence. Then a second vitamin was omitted from the medium, and the process was repeated until a complete, or nearly complete, autotrophic habit was established.

Yeast is a good source of vitamins, but since in its turn it is dependent upon an exogenous supply of growth factors, the question arises whether or not a conversion from heterotrophic to autotrophic habit might not affect vitamin synthesis and storage and thus leave the cell devoid of vitamins. In order to answer this, the writers grew their completely autotrophic strain of yeast in a synthetic medium prepared from vitamin-free chemicals. The cultures were incubated at 25° C for four days; the ensuing crop of cells was then harvested, washed, dried and tested for the various vitamins. This was done by weighing 0.2 gram of the cells for each 100 ml of the nutrient solution, boiling for 5 minutes to extract the soluble parts, filtering, sterilizing and inoculating with the test organisms.

The following organisms were used to detect the different vitamins: *Pythium ascophallon* for thiamin; *Ceratostomella ulmi* for pyridoxin; *Lactobacillus casei* for riboflavin; *Brucella suis* for nicotinamide; *Clostridium acetobutylicum* for para-aminobenzoic acid and strains of *Saccharomyces cerecisiae* for inositol, pantothenic acid and biotin.

Two lots of nutrient solution were prepared. The first lot, containing no vitamins, was divided into two portions; the first portion was used as the control, while the other contained, in addition, the water-soluble parts of the yeast. The second lot of the nutrient medium was divided into eight portions; each portion received all the vitamins mentioned in this paper except one. For instance, the first received all the vitamins except thiamin; the second received all except pyridoxin, and so on down the list. Then each one of the eight portions was divided into halves; the first was used as the control, while the water-soluble parts of the yeast were added to the second half to furnish the missing vitamin.

The bacterial cultures were incubated at 30° C, the yeasts and fungi at 25° C. Very slight or no growth was observed in all the controls, while a rich growth was made in all solutions containing the substances extracted from the yeast cells. This indicates that our strain of autotrophic yeast is capable of synthesizing in appreciable quantities all the vitamins mentioned in this paper.

In the building-up process of vitamin synthesis, the writers have developed many strains of yeasts from a single one. Some of these synthesize and store considerable quantities of vitamins; others produce smaller amounts, or almost none. This work will appear later.

LEON H. LEONIAN
VIRGIL GREENE LILLY

WEST VIRGINIA UNIVERSITY

[1] Published with the approval of the director of the West Virginia Agricultural Experiment Station as Scientific Paper No. 278. The writers are indebted to Drs. S. A. Koser, W. G. Robbins and Robb S. Spray for some of the cultures used in this work.

BOOKS RECEIVED

American Standard Definitions of Electrical Terms. Pp. 311. American Institute of Electrical Engineers, New York. $1.00.

BROWN, F. E. *A Short Course in Qualitative Analysis.* Revised edition. Pp. vii + 367. D. Appleton-Century Company, Inc. $2.60.

CHADWICK, HENRY D. and ALTON S. POPE. *The Modern Attack on Tuberculosis.* Pp. viii + 95. Oxford. $1.00.

Collateral Readings in Inorganic Chemistry. Second Series. Edited by L. A. GOLDBLATT. Illustrated. Pp. viii + 198. D. Appleton-Century Company, Inc. $1.40.

SMART, W. M. *Foundations of Astronomy.* Pp. vi + 268. Longmans, Green and Co. $4.20.

WATSON, H. B. *Modern Theories of Organic Chemistry.* Second edition. Pp. vii + 267. Oxford. $5.00.

SCIENCE NEWS

Science Service, Washington, D. C.

CHEMICAL ELEMENTS NEEDED FOR PLANTS

HEALTHY plants, like good steel, need the addition of minute amounts of a number of chemical elements. Some of them are the same as those required for modern steel making, including manganese, molybdenum and copper.

The story of these "micro-nutrients" was the subject of the address by Professor D. R. Hoagland, of the University of California, as president of the Pacific Division, American Association for the Advancement of Science.

The need of plants for these minute traces of certain elements was completely unknown until a few years ago, and even now it is not certain that the list of micro-nutrients is complete. Of most of them, only a few parts in a million of soil solution are needed to maintain plant health, yet without them the plant sickens and perhaps dies.

Lack of some of these elements produces plant diseases that might formerly have been ascribed to the attack of submicroscopic viruses. Fruit trees in soils without zinc, for example, produce symptoms known as "little leaf" and "mottle leaf." Most soils have sufficient quantities of the micro-nutrient elements for all practical purposes, but where they are lacking it is important to detect which ones are short and to remedy the defect.

Bearing on this subject also are relations between the nutrition of plants and that of the human beings and animals that eat them. Some of the micro-elements in plants are of as great physiological importance indirectly to animal life as they are directly to the life of plants. This field of research is only beginning to be explored.

THE NEW ELECTRON SPECTROMETER

SHOOTING an invisible beam of electrons through a tiny, invisible specimen may eventually permit identification of individual molecules.

The first electron spectrometer, an instrument for finding the composition of such small bits of matter, is being completed by Dr. Albert Prebus at the Ohio State University. Dr. Prebus, with his co-workers, built the first electron microscope to be used in America.

Pictures taken under the electron microscope, like those in the family album, give a physical portrait but seldom reveal the true nature of the individual. Therefore submicroscopic objects, seen for the first time by using the powerful electron microscope, will now be examined with the spectrometer to determine their composition and properties. A better chemical understanding of the mysterious viruses is likely. And it should be possible to follow the reactions which occur in the battle between our virus enemies and the antibody defenses of the blood. Disease-producing germs are in for a similar scrutiny. Just how drugs in turn attack the germs can be investigated by the analyzing beam of electron particles. What makes the sulfa drugs so effective, for example, is one of many such medical controversies.

Rare earth metals are to be used in one of the first research applications of the new device. These rare earths can be recognized even when mixed with other complex materials. Thus they serve as identification tags when attached to other substances. Adventures of these tagged materials in their associations with minute plant and animal organisms can then be followed by using the new spectrometer.

The main advantage of such experiments is that the sample of material can be thousands of times smaller than that required by the best chemical methods. About a hundred thousand such tests can be made from material piled on the head of a pin.

While examining such small particles under the electron microscope, Dr. Prebus got the idea for the spectrometer from a defect in the microscope's operation. This is how it happened. A beam of electrons is used here instead of light to form the magnified image. As these particles of electricity pass through the specimen, they collide with the chemical elements present. Dr. Prebus found that this causes some of the electrons to lose part of their energy and not focus properly. These "tired" electrons were a nuisance. But this loss of energy, it was observed, is always the same for a particular substance. On this basis the electron spectrometer was constructed. By measuring the losses of energy after shooting electrons through a specimen, chemical composition can be interpreted.—GLENN SONNEDECKER.

ORE-SEPARATING PROCESS FOR TIN

TIN for America's wartime needs may presently be coming from ore deposits in the South too low-grade for ordinary methods of extraction, if a new device developed in the Westinghouse laboratories at Pittsburgh operates as successfully on a large scale as it does experimentally. In small-scale tests, it has separated out the worthless rock from the tin so well that an ore of only 1.5 per cent. tin content was converted into a concentrate of 70 per cent. tin—which is quite suitable for smelting.

The machine is patterned after electrostatic cleaners that take dust particles out of the air, furnace gases, etc., by charging them with static electricity. Such devices have been in use for a long time. They take advantage of the attraction between bodies carrying opposite charges —the kind of thing that happens when your hair "follows" the comb.

In the new ore-separating process, the mineral is first ground to the consistency of fine sand. Then it is poured down through a tower, falling toward a slowly rotating metal drum. Just before the particles strike the drum, they receive a charge of static electricity from a series of fine wires. The tin particles, being good conductors, promptly lose their charges to the metal of the drum, and drop off before they reach the bottom of the turn. The poorly conducting rock particles retain their charges and stick to the drum, until they are pulled off as they come opposite a second series of wires, charged with electricity of opposite sign.

The one drawback in the method is the necessity for having the particles powder-dry, because moist particles can not be made to carry a workable static charge. Tried experimentally in the past on low-grade iron and gold ores, it worked all right, but proved economically impractical because of the high cost of drying the material. But with tin on a hang-the-expense basis, it may prove worth while to build some large-scale machines to concentrate our domestic low-grade ores.

A PROPOSED INSTITUTE FOR THE STUDY OF HUMAN HEREDITY

A RESEARCH institute for the study of human heredity can and should be established, according to Professor Earnest A. Hooton, the Harvard anthropologist. Better knowledge of the way physical and physiological traits are handed down from ancestors to offspring would, he feels, do a great deal to offset the ills that will be visited upon the human race as an aftermath of the present war.

Initial staff of such an institution would not need to be very large. Professor Hooton proposes an animal geneticist, a physical anthropologist, a psychologist, a physiologist, a clinical physician, a biometric statistician "and a couple of realistic sociologists," Quarters for such an institution might be available at any first-rate medical school. All that is lacking is some philanthropist long-headed enough to endow an organization aiming at the long-range prevention of much human misery, instead of the mere relief of preventable disasters after they have arrived.

The institution would operate, as Professor Hooton envisions it, by "locating the principals to imminent marriages, studying them from all of the scientific angles which are necessary for a full understanding of their organic and sociological capacities, and then extend that study, so far as possible, to their parents, brothers and sisters.

"Next, the institute would await the arrival of the probably inevitable offspring of these marriages and would follow these through their periods of growth and maturity. The research staff of the institute would not have to twiddle its thumbs until the infants grow up. Neither births nor marriages are uncommon."

An animal analogue of one phase of such a study has been provided by the important but little-noticed breeding experiments with rabbits, carried on for many years by Dr. Wade H. Brown and his associates at the Rockefeller Institute for Medical Research at Princeton, N. J. It might be called an experiment in horrible examples, for Dr. Brown and his staff have mated their rabbits as human beings all too often mate themselves: in such a way as to combine and intensify hereditary constitutional weaknesses. Some of these weaknesses manifest themselves as deformities, others as diseases that "run in the family."

If analogous human hereditary deficiencies could be detected and their bearers discouraged from making the kind of marriages that would pass them on to their luckless offspring, Professor Hooton feels that the cost of the institute which he proposes would be justified many times over.

THE KOREANS

KOREANS have certain physical resemblances to white men, according to Dr. Aleš Hrdlička, of the Smithsonian Institution.

There are three distinguishable racial strains among Koreans. One group, living in territory nearest China, resemble the Chinese. Another, short, stocky and dark, are more like aboriginal inhabitants of Siberia. The third group, comprising the great majority of Koreans, are somewhat taller and have lighter skins. Young people of this type frequently have ruddy cheeks, a rarity among Mongolians. Some of the men have heads shaped very nearly like those of the Alpine racial type in Europe. These resemblances to white men, Dr. Hrdlička suggests, point to a white group of Asiatic origin somewhere in the Korean ancestry.

Where Koreans originally came from is a foggy mystery. They may have migrated to their peninsula from somewhere in northern India, during prehistoric times. But as long as their own and Chinese history tells anything, they have always been there.

In ancient and medieval times they had a high culture and a flourishing civilization. Then, in the sixteenth and seventeenth centuries, the Japanese made their first attempt to conquer all Asia, and the Koreans took the brunt of the attack. The Japanese conquest eventually failed, but Korean national life had been so disrupted and the people so exhausted that they never recovered. They fell into decadence, became a hermit kingdom until unsealed by Europeans in the middle of the nineteenth century, and finally fell easy victims to Japanese imperialism early in the twentieth.

Korean submission, however, is only apparent. Beneath the surface rebellion constantly simmers. This people, too, dreams constantly of freedom.

INSECTICIDES

MUNITIONS for man's ceaseless defensive warfare against insects and plant diseases have been forced onto a scarcity basis because of the war, according to the report by James R. Hile, of the Acme White Lead and Color Works, Detroit, to the eighth annual Chemurgic Conference meeting in Chicago. Part of the shortage is due to the more imperative demands of war industries for materials used in the making of fungicides and insecticides, part to the cutting off of overseas sources by Axis conquests.

Arsenic, the classic stand-by of insect fighters, is hit both ways. About half of the arsenic used in this country comes in normal times from abroad, mainly from Sweden, Belgium and Japan. These sources are lost for the present. At the same time, other industries are demanding larger shares of the arsenic still available. Great quantities are needed in the manufacture of khaki cloth, blankets, etc. Arsenic is demanded in increased quantities for glassmaking. It is also needed for the production of chemical weed killers, to replace chlorates now absorbed by the powder mills.

Rotenone, one of the most important of the organic insecticides, used to come largely from the East Indies, which are now out of the market. South American rote-

none, which used to supply about forty per cent. of the normal requirements of the nation, can be stepped up to perhaps sixty per cent., but not more. This leaves a bad lack, with no replacements in sight.

A similar situation holds with respect to the other great plant source of insecticide, pyrethrum. The principal source of this used to be Japan, but the British African colony of Kenya has almost entirely displaced our present Axis enemy so far as pyrethrum is concerned. The entire requirement for 1942 can be supplied from Kenya, if enough shipping space can be made available.

So far as arsenic and rotenone are concerned, the situation is being saved largely through careful distribution of available supplies. Non-essentials, like grub-proofing of lawns and golf greens and protection of ornamentals, are being put on short rations, and the supplies on hand are being directed to the combating of pests and diseases attacking principal food and fiber crops.

ITEMS

FOUR to seven years' study and training in pure chemistry are necessary before a man can turn his hand to technological applications. It is the duty of educational institutions to provide this training to insure a supply of trained men for the future. This was the message of Dr. Roger Adams, chairman of the department of chemistry of the University of Illinois, at the dedication of Northwestern University's new Technological Institute. The progress of science will be somewhat deterred by its present diversion almost entirely to defense problems, Dr. Adams continued. But it is bound to continue to live and prosper regardless of present handicaps.

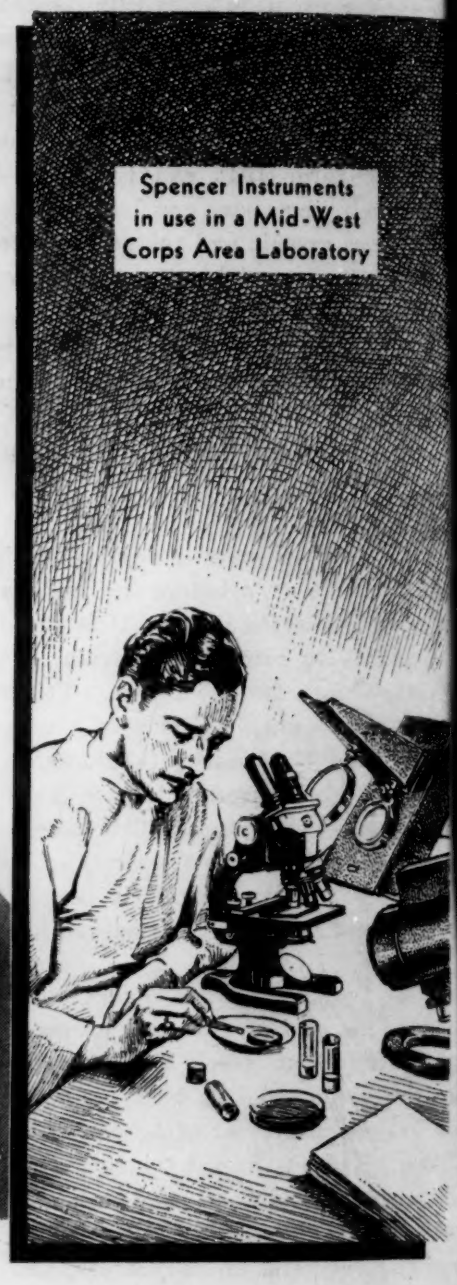
TURF for American airfields, which previously lay in dust, is the gift of golf and science to the war. A radical process, that will in thirty days turn bare earth into healthy green sod, has been perfected by Major H. Burton Musser, professor of agronomy at Pennsylvania State College, who has joined the Army to do the job of giving soil cover to airfields and other military areas. The achievement is doubly significant: as a camouflage measure for vital military areas, and to protect airplane engines against dust which experts say can reduce the life of an airplane by as much as 90 per cent. The process has heretofore been used to provide better greens for America's golfers. Scientists worked hand-in-hand with golf green caretakers in developing it. No blueprinted specifications for the grass-growing method can be given. Each soil type must have its turf overcoat "tailor-made." But in general it consists of pulverizing and mixing soil, lime, fertilizer and grass seed into "floss"; shredding healthy sod; and spreading the two materials, in proper proportions, over the bare area.

ACCORDING to the report of Dr. James Watt, U. S. Public Health Service, and Dr. Jerome S. Peterson, epidemiologist of the Puerto Rico Department of Health, efforts to rid healthy typhoid fever carriers of the germs by sulfaguanidine treatment have failed. Hope that sulfaguanidine, now widely used with considerable success in treatment of bacillary dysentery, might prove a cure for typhoid fever is banished by this report. Sulfaguanidine, in four daily doses of five grams each, was given to six moderately ill typhoid fever patients for eight to ten days. No unusual improvement followed this treatment in any of the patients. They all recovered, but there was no indication that the drug in any way affected the fever or other symptoms.

A NEW plastic, after kneading briefly in the hands, can be thrust into leaks in a sinking lifeboat to plug holes splintered by bullets. Every lifeboat in the British Merchant Service is now equipped with the pliant substance. The plastic has a binding effect and works by settling and hardening in water. Already officially approved by the British for emergency boat repair, it is expected that it will also prove useful in pontoons. American merchant ships have not adopted the plastic. Tapered soft-wood plugs, or bolts with grummets and washers, are supplied for mending leaks; also candle wicking, adhesive tape, and white lead in oil. However, U. S. Coast Guard officials are now experimenting with substances similar to the British plastic. They antipicate that some such material may be adopted for American lifeboats.

HOMELESS men are rehabilitated at an abandoned CCC camp, now operated for them at Jefferson by the State of Maine. Only men unemployable by industry at the time of admission are accepted by the camp. They are cases formerly boarded out in private homes, where meals were poor and skimpy, lodgings frequently firetraps, medical attention insufficient, and recreational facilities limited or lacking entirely. Since its opening, in February, about 140 men have been registered at the camp. Of these, 35 have been rehabilitated, leaving for self-supporting work. Ten to twelve men join the group each week, as state cases are transferred from boarding houses. The newly reopened camp has been transferred from the Federal Government to the State of Maine without cost, after negotiations by state health and welfare officials. It is staffed by a director, assistant director, camp foreman and cook, the only paid employees. Medical services are provided. All other work is done by the men themselves, on a voluntary basis.

BEEF blood from the nation's slaughter houses, now thrown away at the rate of millions of gallons yearly, may be used in the future to save the lives of wounded soldiers and sailors, was pointed out by Dr. A. Newton Richards, chairman of the Committee on Scientific Research of the Office of Scientific Research and Development, in a Science Service radio talk over the Columbia Broadcasting System on May 30. Scientists at Harvard University, he said, are working intensively in the effort to prepare beef albumen in such a form as to be harmless when injected into man. Albumen fights shock because of its ability to hold the fluid in which it is dissolved within the blood vessels. In shock, the blood vessels lose their capacity to keep blood and other fluid inside their walls. Albumen from human blood has already been used effectively in fighting shock in civilian hospitals. A supply was taken to Pearl Harbor and used with dramatic results in the treatment of seven patients.



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